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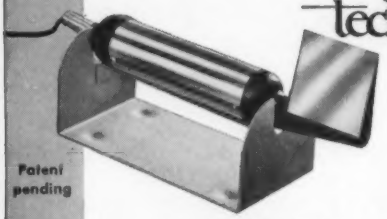

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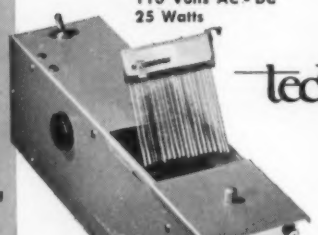

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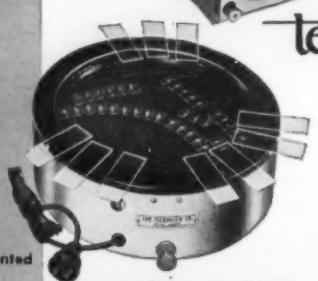

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Temperatures of Pacific Bottom Waters and Polar Superficial Waters during the Tertiary*

Cesare Emiliani

Institute for Nuclear Studies, University of Chicago

GEOLOGICAL and paleontological studies of different kinds by various authors have shown quite conclusively that the temperature at the earth's surface in the middle and high latitudes decreased considerably during most of the Tertiary.

The best evidence is paleobotanical, because plants are particularly sensitive to climatic variations, but the successive fossil faunas show the same trend. Although local factors of geographic significance may occasionally produce disturbances, the true picture is quite evident if the available observations are considered and interpreted globally.

Quite understandably, most authors refrain from giving actual figures in degrees centigrade for climatic variations of the past, although this has been done in some cases. Even when actual figures are not published, however, it is often possible to infer them from the published evidence.

The regions that have been best studied from the paleoclimatic point of view are, undoubtedly, North America and Europe. A decrease of about 12°C from Eocene to Pliocene for the coast of California is implied by Smith (*1*). A similar figure is reached by Durham (*2*) for approximately the same region. The decrease of temperature seems to have been rather continuous in this area. Knowlton (*3*), Ruedemann (*4*), and Chaney (*5*) also conclude in favor of a more or less continuous decrease of temperature during all or most of the Tertiary throughout North America.

In western Europe, the decrease of temperature from the Middle Eocene to the Lower Pliocene seems to have been smaller than in North America. The Eocene London Clay has been assigned a mean temperature of 21°C (*6*); the Oligocene Molasse of Switzerland, 20°C (*7*); the Swiss Miocene, about 19°C (*7*); and the German Pliocene floras, about 15°C (*8*).

It seems, therefore, that temperature changed less during the Lower Tertiary and Miocene in western Europe than in North America. However, a somewhat larger decrease of temperature in western Europe during the Tertiary is suggested by Theobald (*9*). The polar seas are believed to have been free of ice in nonglacial times, and a temperature of 5 to 6°C is assigned to the Arctic Sea by Brooks (*10*).

Evidence in support of these views was published recently (*11*). Benthonic Foraminifera of Middle Oligocene age contained in a deep-sea core raised by the Swedish Deep-Sea Expedition of 1947–48 in the eastern equatorial Pacific (*12*) showed an average temperature of 10.4 ± 0.5°C. This result was obtained by the method of oxygen isotopic analysis, based on the temperature coefficient of the equilibrium constant for oxygen isotopic exchange between water and calcium carbonate (*13, 14*). More recently, samples of benthonic Foraminifera of Lower-Middle Miocene and Uppermost Pliocene age from two other cores collected in the same area were treated by the same method. The pertinent data and the results are shown in Table 1.

The age of core 53 is well established as Middle Oligocene because of the presence of typical specimens of *Cassidulina spinifera* Cushman and Jarvis in all samples examined. The age of core 57 is established as Lower-Middle Miocene because of the presence of *Gyroidina zelandica* Finlay, together with *Laticarinina bullbrooki* Cushman and Todd, in the samples that have been analyzed. Oligocene and Miocene sediments were available for coring because submarine erosion

* This work was done in H. C. Urey's laboratories for isotopic research, under contract AT(11-1)-101, with the Atomic Energy Commission and contract N6ori-02028, Task Order No. XXVIII, with the Office of Naval Research. The author gratefully acknowledges the technical collaboration of G. Edwards and Mrs. Toshiko Mayeda.

Table 1. Samples data and temperature values.

Core No.	Location	Depth of the sea bottom (m)	Age of foraminiferal sample	Temp (°C)
58	6°44′N 129°28′W	4440	Uppermost Pliocene	2.2 ± 0.5
57	8°25′N 128°48′W	4607	Lower-Middle Miocene	7.0 ± 0.5
53	15°34′N 127°11′W	4725	Middle Oligocene	10.4 ± 0.5

or slumping had previously eliminated the younger sediments (*15*). The Pliocene sample was obtained from the lower part of core 58 (509 to 513 cm below the top of the core), some 110 cm below the beginning of the Pleistocene. It is, therefore, to be considered of Uppermost Pliocene age.

In Fig. 1, the temperature results have been plotted against a time scale proposed by Holmes (*16*). The Oligocene and Miocene data are represented by a cross, the horizontal segment of which represents the age uncertainty, while the vertical segment represents the experimental error of the temperature determinations (±0.5°C, corresponding to ±3 standard deviations). The temperature value at time 0 is the present bottom temperature in the vicinity of core 58, obtained from Schott (*17*).

A progressive temperature decrease during the Tertiary is quite evident from Fig. 1, although it was probably more complicated than the few points available would suggest.

The possibility exists that the observed temperature decrease may have been produced by increase of the thickness of the water layer. This could have been brought about in two ways: by regional subsidence or by a rise of the water surface. However, all known cases of subsidence in the Pacific basin appear to be strictly local phenomena connected with volcanic intrusions and extrusions, and subsequent isostatic adjustments (*18, 19*). Most of this evidence comes from the western part of the north Pacific (*18*), but some also comes from the eastern part (*19*). None, however, comes from the area where the cores were raised. On the other hand, all that is known about the Pacific basin indicates that most of it is an area of great stability and has been such for a long time. Therefore, subsidence on a regional scale, such as would be needed here, can be excluded with confidence.

A rise of the water surface over all oceanic areas may have been produced by the great Alpine orogenesis, which transformed into land vast areas previously occupied by the sea. However, the volume of the water so displaced would have been some order of magnitude too small to produce the observed temperature variations. Further evidence against both theories is the good correlation between temperature variations in the area here considered and in North America and Europe.

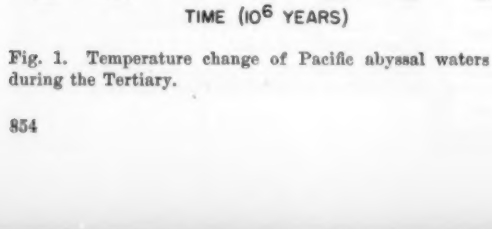

Fig. 1. Temperature change of Pacific abyssal waters during the Tertiary.

The temperature of abyssal waters in the open oceanic basins at all latitudes is conditioned by the temperature of surface waters in the polar areas. It cannot be either lower or appreciably higher, apart from possible adiabatic effects. This uniformity is maintained by superficial water masses that sink to the bottom in the high latitudes and flow toward the lower latitudes as deep currents.

Today, the formation of bottom water is somewhat obstructed by the low salinity of the surface waters at high latitudes, and it takes place only when surface temperature and salinity combine in such a way as to produce water masses of particularly high density (*20*). During the Tertiary, however, the surface salinity of the polar water was certainly much closer to the average than it is now, and the formation of bottom water was easier in spite of the higher temperatures. Therefore, the temperatures of surface polar waters and abyssal waters of open oceanic basins were maintained at close values by the same mechanism now operating, and the temperature data shown in Table 1 are a good estimate of the surface temperatures in the polar areas at the times indicated.

Clearly inadmissible is the reversal in deep-sea circulation in nonglacial times suggested by Chamberlin (*21*), with formation of bottom water at low latitudes and flow of the same toward the poles along the ocean bottom. A temperature difference of only a few degrees centigrade between surface waters in the high and low latitudes would have been sufficient to prevent this phenomenon, even admitting a salinity difference as high as 2 percent.

The circulation of the ocean and atmosphere was probably somewhat different when no ice was present in the polar areas. In the Northern Hemisphere, warm currents reached farther north and, when possible, entered the Arctic basin. In the Southern Hemisphere, the polar water mass was absent or restricted to a narrow belt around Antarctica, and the Antarctic convergence was also absent or considerably displaced southward. Consequently, the temperature gradient along the meridians, in the middle and high latitudes, was much smaller than now, and so were other gradients, such as salinity and isotopic composition.

With regard to the atmospheric circulation, the shallow anticyclones now existing above both polar areas were certainly absent, and the raising wings of the subtropical circulation cells were displaced toward the poles. This again contributed to reduce the climatic differentiation between lower and higher latitudes.

Finally, the bottom water formed in the high latitudes in the absence of ice had an isotopic composition identical or very close to the average, as suggested by Epstein and Mayeda (*22*).

A temperature decrease of some 8°C from the Middle Oligocene to the end of the Pliocene in the deep

waters of the equatorial Pacific reflects and emphasizes the general temperature trend during the Tertiary, which resulted in the ice age. The environmental uniformity of the oceanic depths and the thermic inertia of the oceanic mass reduce the possibility of short time, less important temperature variations being recorded and enhance the value of the paleotemperature measurements here presented as a basis for general discussion.

It is unfortunate that more paleotemperature data from the ocean bottom are not available, particularly from the Eocene, Upper Miocene, and Lower Pliocene. The type of material that is needed, however, makes rather remote the probability of securing additional, suitable samples in the near future.

References and Notes

1. J. P. Smith, *Pop. Sci. Mo.* **76**, 478 (1910).
2. J. W. Durham, *Bull. Geol. Soc. Amer.* **61**, 1243 (1950).
3. F. H. Knowlton, *Bull. Geol. Soc. Amer.* **30**, 499 (1919).
4. R. Ruedemann, *Geologie der Erde* **1**, 88 (1939).
5. R. W. Chaney, *Bull. Geol. Soc. Amer.* **51**, 469 (1940).
6. E. M. Reid and M. E. J. Chandler, *The London Clay Flora* (London, 1933).
7. O. Heer, *Die Urwelt der Schweiz* (Zurich, 1883).
8. M. Schwarzbach, *Das Klima der Vorzeit* (Stuttgart, 1950).
9. N. Theobald, *Geol. Rundschau*, **40**, 89 (1952).
10. C. E. P. Brooks, *Climate through the Ages* (New York, 1949).
11. C. Emiliani and G. Edwards, *Nature* **171**, 887 (1953).
12. This and the other core material discussed in this article were kindly made available by G. Arrhenius.
13. S. Epstein *et al.*, *Bull. Geol. Soc. Amer.* **62**, 417 (1951).
14. S. Epstein *et al.*, *Bull. Geol. Soc. Amer.* **64**, 1315 (1953).
15. G. Arrhenius, *Repts. Swedish Deep-Sea Expedition 1947–1948*, vol. 5, fasc. 1 (1952).
16. A. Holmes, *Trans. Geol. Soc. Glasgow* **21**, 117 (1947).
17. G. Schott, *Geographie der Indischen u. Stillen Ozeans* (Hamburg, 1935).
18. H. H. Hess, *Am. J. Sci.* **244**, 772 (1946).
19. A. J. Carsola and R. S. Dietz, *Am. J. Sci.* **250**, 481 (1952).
20. H. U. Sverdrup, M. W. Johnson, and R. H. Fleming, *The Oceans* (New York, 1942).
21. T. C. Chamberlin, *J. Geol.* **14**, 363 (1906).
22. S. Epstein and T. Mayeda, *Geochim. et Cosmochim. Acta* **4**, 213 (1953).

Contemporary Science and the Poets

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In recent years, the relationships between science and poetry have attracted a considerable quantity of literary criticism. "No poet today," say Levy and Spalding (*1*), ". . . can ignore science. The atmosphere of rational thought that has come with the new knowledge of the physical world, envelops him whether he is conscious of it or not. It is now part of his social heritage, and his poetry draws on it for sustenance." Douglas Bush (*2*, p. 151) makes this sweeping statement: "All modern poetry has been conditioned by science, even those areas that seem farthest removed from it." Dudley (*3*) points out that the science content of a poem may be adulterated but insists that there is a science content.

> No doubt the science in literature is often outdated, distorted or misapprehended, but so great a factor in the pattern of modern life must find imaginative as well as theoretical and technological expression.

Such statements are certainly ego-gratifying for the practicing scientist. Of course, his work has permeated to the heart of modern poetry. Why should not the new biochemical-genetical findings, for example, dominate any poetic myth-making concerned with the durability (or frailty) of man? Generalized theories of gravitation should naturally find their way into poetic metaphor. Is it possible to think about space, about time, without considering these new concepts? We know that the judicious application of certain of the findings of fundamental science has, in the last 50 years, gone far to reshape the way in which our lives are spent. The poets, a human kind of barometer, should be quick and sensitive to register the impact of each fresh discovery, each major theoretical advance. It remains only for the practicing scientist to read the modern poets to discern, mirrored back at him, all of his scientific progress; it should be there, now subtly, now obviously, but there nevertheless.

Another critical view exists, however, that sounds quite different. It is to be sure, a minority view and, one would gather, an unpopular one. J. Isaacs gives it expression (*4*, p. 75):

> I have gone through dozens of volumes and read and re-read hundreds of poems hoping to confirm the belief to which I have referred, that scientific imagery permeates modern poetry, that the poets have been forced by modern science to alter their modes of feeling and expression. Alas! it just isn't true.

So great a divergence of opinion between literary critics about a matter involving science makes it of interest to examine at least some of the poets cited by both groups to determine, if possible, just how the situation strikes a practicing scientist. It may be that modern poetry is influenced to a far-reaching extent by modern science. It may also be that there is no modern science in the works of modern poets, or perhaps the actual situation is somewhat between these two extremes.

At the outset, it might prove of value to state, from the point of view of a scientist, what is not meant by the modern science content of modern poetry. Pos-

sibly the problem of definition is the crux of the matter.

The 1904 revolution in physics caused an upheaval in more areas of intellectual endeavor than just physics. Fundamental philosophic thinking underwent new direction for the age-old problems, such as determinism and free will. The concept of the very nature of scientific truth had also to be placed in a new frame of reference. Since poetry is quite frequently concerned with philosophy, there is a chance that philosophic content will form the basis for judgment of the science content of modern poets. For a scientist such a juxtaposition is a curious one; the fact that it occurs as often as it does means that, in the mind of the nonscientist, it is a juxtaposition seductively easy to make.

What is not meant, then, by modern science content of modern poetry is philosophic content. What is not meant, too, is value judgment, particularly value judgment of "things" which of themselves can support no value judgment. There has been at least one poem (fortunately, a very bad poem) in which the phrase "vicious electron" appears. Since an electron can be no more vicious that it can be benign, or ludicrous, or poverty-stricken, a phrase of this kind is meaningless for a scientist. It represents an extreme and bizarre example of a chronic, hard-to-correct condition, the condition of imputing motives to inanimate systems. Such usage is neither philosophic nor scientific, and poems containing it cannot be considered.

It is also not meant in a consideration of the science content of contemporary poetry to examine those poems which equate the products of applied science with science itself. Present-day outlook confirms what has been known for a long time: science is an attitude, a method, a point of view related to the "particular go of things," to borrow Maxwell's happy phrase. Now, a machine, no matter how cleverly constructed, is not, by these terms, science; it is, rather, a product of science. There is considerable confusion because of such equating, not only among critics, but among the poets themselves. Hart Crane provides an example. In an essay about the function of modern poetry, he says (*5*):

> Analysis and discovery, the two basic concerns of science, become conscious objectives of both painter and poet. . . .
>
> The function of poetry in a Machine Age is identical to its function in any other age; and its capacities for presenting the most complete synthesis for human values remain essentially immune from any of the so-called inroads of science. . . . For unless poetry can absorb the machine, i.e., *acclimatise* it as naturally and casually as trees, cattle, galleons and all other human associations of the past, then poetry has failed of its full contemporary function.

Throughout the entire essay the words *science* and *machine* are used interchangeably, not because of any ambiguity in Crane's own mind about what he felt modern poetry should do, but probably because, to him, the words were completely synonymous. There are some scholars, it must be admitted, who regard this statement of Crane's with a feeling almost akin to embarrassment. In the hands of the less discerning, though, it is taken to show that Crane was an apologist for modern science.

These three, then, are what is not meant by the modern science content of modern poetry: philosophic content, ambiguous use of isolated terms, and equations involving products of science with science itself. What is meant is the appearance in poems of the newer theoretical concepts and broad points of view; what is meant, too, is the scientific spirit, the scientific attitude.

If there are present any of the unifying conceptual developments, it is to be anticipated that some of the terms of science will appear, used in a scientific way. For example, the phrase "atom of truth" might not qualify as a phrase showing the absorption of a scientific concept, but lines like (*6*)

> . . . the Sun's attractive force
> Builds energy in spirals that never cease.

might well be a reflection of one of the newer physical theories.

There is a risk in suggesting that what might be found in the modern poets is the scientific spirit or attitude. Perhaps some critics and some poets will say that should this spirit, this attitude, be present, it will be so at the expense of the "poetic spirit" or "attitude." Possibly this is a legitimate objection, but it would also seem that if the notion is accepted that modern poetry contains modern science, then we must face up to the fact that the scientific attitude will be there too, however antipoetic we might feel it to be.

II

Who are the poets that might be examined by a scientist for their science content? To have read all modern poets would be impossible, if not foolhardy. First examination should include the poets most often cited by critics as those who have been influenced by modern science, but so restricted a list automatically places limitations on the conclusions derived from the study.

If one examines three "major" poets and finds that there are significant references to modern science in all three, it is quite incorrect to state that "all modern poetry" is conditioned by modern science, because, for every three references to "modern" science, there might be three more (of comparable poetic significance) to Galen, Paracelsus, or Linnaeus. If, in the poets examined, there are no references to modern science, it would be just as wrong to state categorically that contemporary poetry contains no contemporary science.

As the practicing scientist well knows, the "method of exhaustion" as a method for formulating a generalization is always open to the limitation imposed by the problematical existence of one instance that is contrageneralization. At the very beginning, this means that *as a scientist* it is never possible to say

"all poets" or "all science" without doing some violence to conscience and scientific honesty.

The poets most often cited by the critics are T. S. Eliot, A. MacLeish, Edith Sitwell, W. H. Auden, Robert Frost, and Hart Crane, among others. It is with some of these that we shall first concern ourselves.

Larrabee (*7*) about a year ago stated that "T. S. Eliot has encompassed more science than science has encompassed him." Unfortunately, the statement was left unsupported. Waggoner (*8*, pp. 74–5) states that Eliot's poetry contains a "complete condemnation of scientism, and on occasion, of science." He splits Eliot's condemnation of science into three separate kinds of condemnation. Two of them, the feeling that belief, that "faith, in scientific 'facts,' belief that 'rational knowledge of causes' will solve our problems, is a mean and pitiable delusion," and the feeling that science "has offered us a view of life that is unbelievable and intolerable," are really philosophic comments. The third, that "science has removed the mystery. When 'the bright color fades,' 'when the glow upon the world departs,' it is science that is at fault," is a comment somewhat less philosophic. Eliot suggests, of course, that the mystery, the "bright glow" may have been illusory to begin with, but be that as it may, the fading of the glow and the nostalgia for it is not an entirely new comment. Waggoner points out that Poe, in his time, made the same complaint against science. Keats took issue with Newton, because, since the rainbow had been unwound, it now lay "In the dull catalogue of common things."

In order to make these charges, Eliot does use scientific notions, but, for a practicing scientist, they do not seem to be the same ones that strike a literary critic. The critic (*8*, p. 88) seizes upon the symbols fashioned from nerves, from surgery, from rituals discovered by anthropologists, from taxonomic classifications made by geologists and biologists, from dreams of a Freudian nature. The scientist finds more striking lines like (*9*, p. 179):

> The endless cycle of ideas and action,
> Endless invention, endless experiment,
> Brings knowledge of motion, but not of stillness.

or (*9*, p. 109):

> Because I know that time is always time
> And place is always and only place
> And what is actual is actual only for one time
> And only for one place.

It is interesting, too, to a scientist, to read of the use to which Eliot puts the limitations of science—limitations, incidentally, which all scientists are the first to proclaim. Consider these lines (*10*):

> We understand the ordinary business of living,
> We know how to work the machine . . .
>
> But the circle of our understanding is a very restricted area.
> Except for a limited number
> Of strictly practical purposes
> We do not know what we are doing.

Waggoner (*8*, p. 76) feels that these lines form the basis for one of the indictments of science, which seems rather stretching a point. The indictment seems to be more of the "we" in the poem and concerned *on the surface* with the machine.

Bush (*2*, p. 162) comments on Eliot's symbols as a sign of his absorption of modern science. He says, for example, ". . . while airplanes . . . fly all through modern poetry as symbols of scientific slaughter and destruction, Mr. Eliot's use of the image is unique." The phrase "symbol of scientific slaughter" jars a scientist; to be sure, no one would disallow a poet the equating of killing with an airplane, should he so please. That a poet or anyone else would say it is a symbol of "scientific" slaughter is something else again, for this would mean killing in the spirit of free inquiry. It is doubtful that any poet ever meant *this*.

After reading Eliot's poetry, the scientist is likely to feel that Eliot is not uniquely aware of contemporary science, and what is usually called his science content is much more often his personal metaphysic. In the poems of Archibald MacLeish and Robert Frost, however, the scientific reference stands away from the philosophy and seems, too, to be more contemporary.

MacLeish writes many times with one eye on new physical theory. Consider, for example, part II of "Signature for Tempo" (*11*, p. 28). He writes:

> These live people,
> These more
> Than three dimensional
> By time protracted edgewise into heretofore
> People

The date of this poem is 1926. In 1929 appeared the very fine, long poem "Einstein." For the scientist, it is an interesting one, because it shows the awareness of the poet to the content of the early versions of the Einstein theories and the kinds of calculations that went into them. The poem reads, in part (*11*, p. 230):

> . . . he lies upon his bed
> Exerting on Arcturus and the moon
> Forces proportional inversely to
> The squares of their remoteness and conceives
> The universe.
>
> Atomic.
>
> He can count
> Oceans in atoms and weigh out air
> In multiples of one and subdivide
> Light to its numbers.

A scientist is struck, too, by the acute awareness of MacLeish to the time-space relationship. In "You, Andrew Marvell" (*11*, p. 50), starting from the lines of a poet of the 17th century (*12*):

> But at my back I alwaies hear
> Times winged Charriot hurrying near

he expresses an inexorable flow of time, as well befits a man of this day, in space units. The point has been made both by Waggoner (*8*, p. 144) and Pearson (*13*, p. 159).

Robert Frost writes with some of the same aware-

ness of theoretical physical science—the difference lies, of course, in the use to which he puts his awareness. A comment on a cosmology, for instance, is found in "It Bids Pretty Fair" (*14*, p. 44):

> The play seems out for an almost infinite run.
> Don't mind a little thing like the actors fighting.
> The only thing I worry about is the sun.
> We'll be all right if nothing goes wrong with the lighting.

These lines are interesting in conjunction with the poem "Epistle To Be Left in the Earth," by MacLeish (*11*, p. 61). Apparently in the latter case, the same subject matter is under consideration, for the poem, a statement of all the knowledge of man to be handed to future generations or future inhabitants of the world, begins with the line ". . . it is colder now," and ends with "It is very cold/ there are strange stars near Arcturus."

The second law of thermodynamics appears in Frost's "West Running Brook," (*15*)

> Our life runs down in sending up the clock . . .
> The sun runs down in sending up the brook.

Frost's short poem, "Innate Helium" (*14*, p. 29) depends almost entirely for its interpretation on a knowledge of the properties of the rare gas.

Of special interest (aside from their charm, wit, and lucidity) to the scientist are two poems of Marianne Moore. In "Four Quartz Crystal Clocks" (*16*, pp. 116, 173), there appears a restatement of a leaflet reporting work at the Bell Telephone Laboratories (1939):

> There are four vibrators, the world's exactest clocks;
> and these quartz time-pieces that tell
> time intervals to other clocks,
> these workless clocks work well;
> independently the same, kept in
> the 41° Bell
> Laboratory time
> vault.

Later on, in the poem,

> We know . . .
> that a quartz prism
> when the temperature changes, feels
> the change and that the then
> electrified alternate edges
> oppositely charged, threaten
> careful timing, so that
>
> this water-clear crystal as the Greeks used to say,
> this 'clear ice' must be kept at the
> same coolness. Repetition, with
> the scientist, should be
> synonymous with accuracy.

The poem "Icosasphere" (*16*, pp. 142, 175) relies for part of its idiom on the work of J. O. Jackson of the Mellon Institute, described in a report by Kaempffert in the *New York Times* of Feb. 5, 1950. In this poem, the heart of the report is paraphrased in a disciplined metrical line so that the line "fits" the idea being conveyed. Critics of the science content in poetry seem to have overlooked these two poems.

On the other hand, the comment is made repeatedly that Auden demonstrates a high content of science. This may be true, but as in the case of Eliot, the philosophy obscures the content, overlays it, and makes the evaluation extremely difficult. Because Auden writes primarily of urban society and urbanization, the critics are inclined to take references to machines, again, to products of applied science (for example, use of antibiotics) as evidence of science content. Isaacs (*4*, p. 77) feels that the science content of Auden (and of L. MacNeice) is predominantly that of social science; he points out, though, that the "New York Letter" (*17*) contains in its notes references to Spemann's *Embryonic Development and Induction*.

III

Discussion of the science content of contemporary poetry leaves untouched the fact that the practice of science insists on an attitude and insists on the use of a generally understood, but hazily defined, methodical approach. To what extent has this insistence permeated modern poetry? To give an answer here is of far greater difficulty than to answer the question: Is there science content in poetry? Methods of accomplishment are rarely reflected in the accomplishment itself, except to the extent that the method places a limit on the nature of the accomplishment. An attitude or spirit is even less tangible; the only index to attitude can come from the total impression after the work has become a discernible entity. Even then discovery of attitude is made complicated by the fact that two attitudes are involved, the attitude of the creator and the complex of attitudes of the discoverer. So interwoven are all these factors that any evidence will be secondary or even tertiary. It should be evaluated as such.

It is secondary information that has thus far been uncovered. It derives from the prose writing of Ezra Pound. The qualifications for citing it stem directly from Pound's unique position in modern poetry as the "Father" of many modern poets, or, perhaps by now, the "Grandfather." Pound strove to remove from poetry the imprecision in language usage that characterized the late Victorians. The number of poets who acknowledge their indebtedness to him is astonishing. One is rather sure that his influence is even greater than any printed list of names would indicate. For a scientist, his statements on precise language are very reminiscent of the writings of Lavoisier and the papers of the Royal Society that deal with almost the same subject. Pearson (*13*) has also noted this.

In *The A B C of Reading* (*18*) Pound's advice to poets is that they should "look to the biologists." In another place, he tells them to "look to the scientists." The reason for looking to these people is that in them one finds ways in which abstractions are developed and, in particular, ways in which they are to be used. Pound's own poems seem to have been written with an awareness of this power. Of course, it cannot be said that he learned how to make abstractions from a study

of scientific methods, or whether he cited the biologists as a clear and obvious example of another group of workers who also deal in abstractions. What can be said is that the thought processes that are successful in transforming scientific techniques are, in some measure, similar to those operating to transform poetic techniques. The transformation is possible because the subject matter of science, abstractions, also occupies a dominant role in poetry. The difference is one of degree only, for the essential nature of the abstracting process is the same, whether it be used to extract the properties of a collection of selenium atoms or the characteristics of man's philosophic dilemma.

Pearson (*13*, p. 160) concludes:

> Science has performed an inestimable service to modern poets in forcing them by a redefinition of physical reality to search out a revitalized manner of expression. . . . Science gave in her new terms a fresh beginning to poets. They served as challenges to poetical clichés.

The statement is a little one-sided. Poetic usage of science, of the scientific attitudes and spirit, performs an "inestimable service" for scientists, too. Poets as such will probably never suggest the direction of future scientific inquiries, but they will always provide a fairly reliable index of the extent of popularization of major scientific advances. Poetry is a reliable index because it is unself-conscious; it is only fairly so because of the necessary time lag between the publication of a scientific concept and republication of the poetic distillation of that concept. Possibly no other index of this quality exists, being, as it is, almost an artifact of the poetic energy, not the *raison d'etre* for poetic expression. Scientific content seems to be used only as one of the ways for creating and heightening the expression, itself extrascientific.

References and Notes

1. H. Levy and A. Spalding, *Literature for an Age of Science* (Methuen, London, 1952), p. 129.
2. D. Bush, *Science and English Poetry* (Oxford Univ. Press, New York, 1950).
3. F. A. Dudley, *Science* **115**, 412 (1952).
4. J. Isaacs, *The Background of Modern Poetry* (Dutton, New York, 1952).
5. H. Crane, *The Collected Poems of Hart Crane* (Liveright Publ., New York, 1916), p. 177.
6. S. Rodman, in *One Hundred Modern Poems* (New Am. Library of World Literature, New York, 1952), p. 179.
7. E. Larrabee, *Science* **117**, 395 (1953). He stated also, "I have not contrasted poetry with science in the naive belief that all scientists are by definition insensitive to poetry," and supports this argument with references to Bacon, Newton, and Blake. The "method of exhaustion" here played Larrabee false, for it would have been as easy to cite Chaucer, J. C. Maxwell, or Dante and arrive at precisely the opposite conclusion.
8. H. H. Waggoner, *The Heel of Elohim* (Univ. of Oklahoma Press, Norman, 1950).
9. T. S. Eliot, *Collected Poems of T. S. Eliot* (Harcourt, Brace, New York, 1947).
10. T. S. Eliot, *The Family Reunion* (Harcourt, Brace, New York, 1939), p. 127.
11. A. MacLeish, *Collected Poems 1917–1952* (Houghton Mifflin, Boston, 1952).
12. A. Marvell, *The Poems and Letters of Andrew Marvell*, vol. 1, H. M. Margoliouth, Ed. (Clarendon Press, Oxford, 1927), p. 26.
13. N. H. Pearson, *The American Writer and the European Tradition*, M. Denny and W. H. Gilman, Eds. (Univ. of Minnesota Press, Minneapolis, 1950), p. 154.
14. R. Frost, *Steeple Bush* (Henry Holt, New York, 1974).
15. R. Frost, *Collected Poems of Robert Frost* (Halcyon House, New York, 1940), p. 329.
16. M. Moore, *Collected Poems* (Macmillan, New York, 1951).
17. W. H. Auden, *New Year Letter* (Faber and Faber, London, 1941).
18. E. Pound, *The A B C of Reading* (New Directions, Norfolk, Conn., 1951).

A Treasurer Retires: W. E. Wrather

Howard A. Meyerhoff

Scientific Manpower Commission, Washington, D.C.

IN March 1940, a score of scientists met in Dallas to make preliminary plans for the first annual meeting of the American Association for the Advancement of Science ever to be held in Texas. At Washington headquarters, there was some trepidation about holding a convention at a point so distant from the northern and eastern centers of learning, where scientists are concentrated in largest numbers, but the warmth and sincerity of the invitation from Texas had been persuasive.

Foremost among the decisions to be made was the selection of a general chairman for the meeting. By tradition, born of experience, the general chairman must be an eminent scientist who not only commands the respect of his fellow-scientists but also enjoys the confidence of the entire community. He must be a leader, a man who can get things done and with whom everyone will cheerfully cooperate. Of the several men proposed, only one had all these exacting qualifications. By unanimous consent, the group chose William Embry Wrather, an oil geologist whose successful consulting practice and wide scientific contacts had made him not simply an eminent local businessman but a prominent citizen of Texas and a scientist with a nation-wide reputation as well.

Dr. Wrather had been a member of the AAAS since 1917 and a Fellow since 1925, but this was his first major role in Association affairs. The success of the Dallas meeting, handicapped as it was by the tension and confusion that followed upon the attack on Pearl Harbor only 3 weeks before, was an achievement for which William E. Wrather must be given generous credit. It was, however, just the beginning of a long and valuable period of service.

Not long after Pearl Harbor and the Dallas meeting, Dr. Wrather was called to Washington to func-

William Embry Wrather. [Courtesy U.S. Geological Survey]

tion as associate chief of the Metals and Minerals Division of the Board of Economic Warfare. Only a year later, in 1943, precedents were broken when he was chosen to succeed W. C. Mendenhall as director of the United States Geological Survey. His predecessors in this post had all been career geologists in government service, and to be picked to head an expanding agency with heavy wartime responsibilities was a tribute to Dr. Wrather's scientific competence and his effective but unostentatious administrative genius.

Impressed with his performance at Dallas, the Association quickly made the most of his move to Washington by appointing him treasurer when Charles Carroll Morgan resigned to enter the Navy in 1943. In the 11 years that have elapsed since his appointment, AAAS membership has doubled (24,000 to 48,000); *The Scientific Monthly* and *Science* have been acquired, and the editorial and business management of the journals has become headquarters responsibilities; to accommodate its expanding operations, the administrative staff vacated the quarters it had so long occupied through the generosity of the Smithsonian Institution and moved into the Association's newly purchased property at 1515 Massachusetts Avenue, NW. These changes not only reflected healthy growth; they also recorded a conversion from a quiet, essentially academic scientific society to an energetic organization engaged in big business. William E. Wrather had the perspicacity and investment experience to ease the Association through this transformation, with the able assistance of a shrewd and conservative Finance Committee.

Although the AAAS Constitution charges the treasurer merely with responsibility for endowment funds, good sense and sound practice have made him a member of the Board of Directors, of the Finance Committee, of the Budget Committee, and of the Council. From these vantage points, Dr. Wrather has watched Association receipts and expenditures with critical care. From 1948 to the time he submitted his resignation in 1953, his guiding hand was an important factor in realizing substantial gains from invested endowment and special funds, in increasing investments from approximately one-quarter million to 1 million dollars, and in making the income from investments the third largest source of revenue in Association operations. He will no doubt insist that credit for these accomplishments should be generously distributed among his associates, but they all know that, for the sound, not to say prosperous, financial position that the Association enjoyed at the end of 1953 and for more than 10 years of unflagging attention to the Association's financial affairs, the membership owes William Embry Wrather its deep and lasting gratitude as he steps into richly merited retirement from an office that he has discharged with distinction and at no small personal sacrifice.

His many other honors—the presidencies of the American Association of Petroleum Geologists, the Society of Economic Geologists, and the American Institute of Mining and Metallurgical Engineers, not to mention the recent award of the John Fritz Medal—have been accepted by him with the same humility and conscientiousness as his post at the AAAS. Always he has been less impressed with the recognition accorded him by his associates than he has with his responsibilities to them. Tributes and acclaim rest uneasily upon his shoulders, but it is hoped he will accept the deep gratitude of the Association for a task well done.

Earnest A. Hooton: 1887-1954

Harry L. Shapiro

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ON May 3, 1954, Earnest A. Hooton, shortly after completing his lectures for the day, died unexpectedly of a heart attack in the 66th year of his life. This was a loss that his colleagues and his many acquaintances will long regret and his more intimate friends will always mourn. He was widely known, both professionally and to the general public; he was the dean of the physical anthropologists of this country, a distinguished professor at Harvard, a brilliant writer who could clothe his scientific ideas with wit and elegance, and above all, he was one of the best loved teachers in his field.

Earnest A. Hooton was born in Clemansville, Wis., on Nov. 20, 1887, the son of William and Margaret Elizabeth (Newton) Hooton. Being the son of a clergyman may or may not be significant, but, in the familiarity with Scripture that Hooton's writing reveals, one is tempted to see the clerical influence of his father. Hooton began his career as an instructor at Harvard in 1913 and remained there for the rest of his life. He became very attached to Harvard and Cambridge, and no offer could ever tempt him to leave the niche that he had made for himself there. On June 3, 1915, he married Mary Beidler Camp and from this marriage issued three children. He and his wife created a hospitable milieu in their home, which became a kind of luminous fixture that drew to them a wide variety of friends.

For many of his former students and colleagues, a visit to Cambridge always meant a visit to Hooton, usually to his house on Buckingham Street where teatime had grown to be an institution for the current crop of students. Tea at the Hootons' was certainly not listed in the University catalog as an educational inducement for prospective scholars, but many of them who, generation after generation, gathered for it must now look back on those afternoon assemblies, not only as one of the pleasantest interludes in their social life at Cambridge, but as an extraordinarily effective means of furthering their education. For at these occasions they met Hooton in a warm and friendly atmosphere, enjoyed his guests, and incidentally and painlessly learned to value his standards of professional integrity and to exchange ideas in a way not possible in the lecture-room. The success of these charming and delightful visits grew out of Hooton's genuine interest in his students. He thoroughly enjoyed their company, and few could fail to respond to and expand under so beneficent a spirit.

Although trained as a classicist at Lawrence College (B.A. 1907) and subsequently at the University of Wisconsin (M.A. 1908, Ph.D. 1911), Hooton shifted his interest to anthropology while he was at Oxford where he held a Rhodes scholarship from 1910 to 1913 and received a diploma in anthropology in 1912 and a B.Litt. in 1913. In his wry way, he used to attribute this abandonment of the classics to his inability to cope with the erudition of the great Gilbert Murray whose seminars he was expected to attend. The fact is, however, that R. R. Marett, to whom he later dedicated one of his books, exercised a strong influence in determining this choice—an influence that Hooton always cherished. To Sir Arthur Keith, Hooton used also to acknowledge a debt that went back to his student days at Oxford and England.

Although Hooton's first anthropological essays were archeological and his first courses at Harvard dealt with the cultural aspect of his subject, he soon became increasingly interested in the biological phases of anthropology. In the end, physical anthropology came to absorb him almost exclusively, both in research and in teaching. In fact, one can truly say of his career that the history of physical anthropology in this country is Hooton's history as well. When he began teaching the subject, his courses constituted the only and, I think, the first professional curriculum to be offered in the United States. And for a long time, until his students began to populate other seats of learning, he remained the only center for such training. Even up to the end, he was always the principal teacher of physical anthropology in this country and the most prolific one. Most of the physical anthropologists in the United States today are his former students or, at one remove, students of his students.

His influence, however significant in manning physical anthropology, was equally massive through his scientific productions. The first of his major studies grew out of a joint enterprise undertaken with Oric Bates. This was to have been a survey of North Africa, Bates beginning at the eastern end and Hooton working from the western. As his initial venture, Hooton went to the Canary Islands to investigate the Guanche problem and to determine what connection these prehistoric and mysterious people had with the mainland. The results were published in 1925 as *The Ancient Inhabitants of the Canary Islands*, volume 1 of the Harvard African Studies, which as editor Hooton established as a medium for the contemplated studies. His independence of mind and his boldness of concept, characteristics that generally distinguish his work, were already clearly evident in this first large-scale investigation. His use of biometric methods was notable here too, since he was a pioneer in this respect and did much to advance their application in physical anthropology.

Apart from several shorter papers on the subject, the only other large craniological investigation Hooton

carried out was a study of the extensive material excavated by A. V. Kidder at Pecos Pueblo in New Mexico. This appeared as the *Indians of Pecos* in 1930 and gave him an opportunity to address himself to the broad question of American Indian origins and affiliations. Like his other work of this order, it is marked by an unusual combination of meticulous detail and a broad sweeping view.

This predilection for speculation, a trait that enlivened his lectures and breathed life into the solid facts and figures he never failed to set forth for his students, induced him, in a measure, to embark on the writing of perhaps his best known work, *Up from the Ape,* which appeared in 1931, was revised in 1946, and went through a number of printings in both editions. He used to say when he was writing this book that it was a relief to get away from the tables of data that required a restricting and conventionalized type of analysis. Here, at any rate, the Hootonian style opened into full blossom. The writing is witty, gay, sometimes a little irreverent, always respectful of the facts, and teeming with stimulating ideas. It was unprofessorial and shocked the more conventional a little, but it has weathered extraordinarily well and is still read with delight.

There now followed a succession of books written with a minimum of scientific jargon and designed to reach the general intelligent reader and to be of significance to the professional reader as well—surely a difficult task, but one in which Hooton succeeded. These were *Apes, Men and Morons,* 1937; *The Twilight of Man,* 1939; *Why Men Behave Like Apes and Vice Versa,* 1940; *Man's Poor Relations,* 1942; *Young Man, You are Normal,* 1945. In these books, he ranged widely over the field of physical anthropology, bringing its lessons home in pungent language. But through them all ran a deeply serious concern with the welfare of society and human population. He saw various dysgenic trends operating unchecked and threatening the health and future of mankind. And these he signaled out for attack and challenge. Often he took a rather unpopular line, but he had a transcendent moral courage that gave him strong support in the face of criticism.

Perhaps in this brief account, there is space to mention only two other lines of investigation that engaged Hooton deeply. One was his study of the American criminal, on which he published two books: *Crime and the Man* and *The American Criminal,* volume 1. This was intended to be a biological and constitutional study of the criminal population of the United States and was executed with great pains. The premises of the study were severely attacked and, to some extent, its impact has been discounted, but in spite of this there is much of great value in these two volumes, which may someday be more fully recognized.

The last years of Hooton's career of research were devoted to constitutional studies. His work in this area is now mainly hidden in reports to government agencies and is, unfortunately, not generally available. As a corpus it is enormous and represents years of devoted labor.

Professionally Hooton was a leading figure. He was a member of a number of scientific societies; he was honored by election to the National Academy of Sciences, the American Philosophical Society, the American Academy of Arts and Sciences. He held only as many offices as he could be induced to accept, for he disliked office-holding. He was a Viking medalist for 1947 and received honorary degrees from Lawrence College and the University of Wisconsin, his alma maters.

Great as he was as a teacher, as a scientist, and as a writer, there was something greater still for those who knew him well. For them the finest thing about Hooton was himself.

News and Notes

Association of Southeastern Biologists

The 15th annual meeting of the Association of Southeastern Biologists was held at Louisiana State University, Apr. 15–17. The Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club met with the Association. There were 234 biologists from 16 states in attendance.

In addition to 60 papers presented by members, there were two symposiums. In the one dealing with marine biology in the Southeast, Harold J. Humm and Charles B. Metz of Florida State University discussed the 23 marine stations along the Atlantic and Gulf Coasts of the region. They pointed out that excellent facilities and abundant biological materials are available to investigators throughout the year. A symposium on biology teaching focused attention on the present problems in that field. Speakers were J. Harvey Roberts of Louisiana State University, John A. Behnke of the AAAS, and Karl A. Stiles of Michigan State College. The annual address was delivered by Edgar Anderson, Director of the Missouri Botanic Garden. His topic was *"Rosa alba,* the white rose of the Renaissance."

The ASB Research Prize of $100, offered annually by the Carolina Biological Supply Company for the outstanding paper at the meeting, was awarded to William J. Brett of Millsaps College for his paper, "Persistent diurnal rhythmicity in *Drosophila* emergence." Honorable mention went to James H. Gregg, Alice L. Hackney, and Jerome O. Knivanek of the University of Florida for their paper, "Nitrogen metabolism of whole and fragments of the slime mold, *Dictyostelium discoideum,* during growth and morphogenesis."

W. B. Baker of Emory University was presented the $100 merit award, given each year to a member

of ASB by the Southern Scientific Company for outstanding contributions to the biological sciences, especially in service to young people through teaching.

Benjamin I. Johns of Alexandria, Va., was announced as recipient of the $200 Phipps and Bird Research Fellowship for study at the Mountain Lake Biological Station.

The Association will meet with the American Institute of Biological Sciences in Gainesville, Fla., in Sept. 1954. Members voted to hold the next annual meeting at The Citadel in Charleston, S. C., Apr. 21–23, 1955.

Officers elected were pres., H. R. Trotter, University of North Carolina; pres.-elect, Alvin V. Beatty, Emory University; and v. pres., Fred T. Wolf, Vanderbilt University. Ruth M. Jones of Winthrop College and Harold J. Humm of Florida State University were elected to 3-year terms on the Executive Committee. Mary Esther Gaulden of Oak Ridge National Laboratory will continue as secretary, J. Paul Reynolds of Florida State University as treasurer, and Victor A. Greulach of University of North Carolina as editor of the *ASB Bulletin*.

MARY ESTHER GAULDEN
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Science News

With the award of two grants for registration of chemists and engineers in the United States, the National Science Foundation has launched the first phase of its program to establish a **National Register of Scientific and Technical Personnel.** Registration of chemists will be undertaken by the American Chemical Society, and during the next few weeks, the Society will send out questionnaires to an initial list of 50,000 chemists. Information will be kept current by the Society. Duplicate copies of the information will be made available to the Foundation for statistical studies and to assist in the mobilization of scientists in time of war. The information will not normally be used for employment or placement of scientists.

The registration of engineers will be conducted by the Engineers Joint Council. At present an attempt will be made to obtain information, not on all of the estimated 500,000 engineers in the United States, but on about 20,000 leaders in engineering fields. This selection will be based on *Who's Who in Engineering* and other sources. Experience during World War II indicated that such a "finder's list" of leaders may provide an effective means for locating engineers for special projects. The engineers list will be maintained on a current basis by the Engineers Joint Council.

At the present time 10 professional societies or groups are collecting registration information for the National Register of Scientific and Technical Personnel. The list and the estimated number of registrants to be gathered by each follows: American Institute of Biological Sciences, 40,000; Federation of American Societies for Experimental Biology, 10,000; American Veterinary Medical Association, 14,000; American Geological Institute, 18,000; American Psychological Association, 11,000; American Institute of Physics, 15,000; American Meteorological Society, 10,000; American Mathematical Society, 12,000; American Chemical Society, 65,000; Engineers Joint Council, 20,000.

The decentralized nature of the Register has led to duplication of names in some cases, and individuals who are competent in more than one field may receive questionnaires from two or more societies. Elimination of duplication will be possible after the Register is in operation; then only one copy of the periodic follow-up questionnaire will be mailed to each registrant.

Estimates of the **geologic age of the Australopithecinae,** the so-called "man-apes" of South Africa, have varied from Upper Pleistocene to Upper or even Middle Pliocene. Kenneth P. Oakley [*Am. J. Phys. Anthrop.* n.s. **12**, 9 (1954)] has recently reassessed all lines of available evidence and concluded that the known species range from the middle of the Kageran (Upper Villafranchian) into the Lower Kamasian stage; that none is certainly older than the earliest recognized pebble-tools (found, for example, in early Kageran gravels in Uganda); and that some were undoubtedly contemporary with toolmakers in South Africa. The known specimens fall into an older group (Makapan, Taung, and Sterkfontein) and a younger group (Swartkans and Kromdraai). The older specimens are thus broadly contemporary with the large-brained hominids of the *Pithecanthropus modjokertensis* group recovered from the Djetis Beds of Upper Villafranchian age in Java. Oakley concludes that the Australopithecines were not the pebble-tool makers; rather, they lived contemporaneously with the more advanced hominids that made them. Nor does the evidence support claims that the Australopithecines made any sort of tools, although they may have used ready-to-hand tools and weapons or may have been fire-users. Thus it appears that the earliest known Australopithecines are not old enough geologically to have been ancestors of the first tool-making hominids. If Oakley's interpretation is correct, the claims of some workers that the Australopithecines were the direct ancestors of man will have to be abandoned. At most, they would constitute a line collateral to the immediate forerunners of the genus *Homo*.—W.L.S.

Laying of the first **transatlantic submarine telephone cable** is scheduled to begin fairly soon. The cable, 2000 nautical miles long, will run between Oban in the West of Scotland and Newfoundland, where it will connect with another submarine cable to Nova Scotia. From there the line will go overland to the U.S. border.

In the existing system of transatlantic telephone communication, a radio system dating back to 1927, there are 12 circuits between Britain and the U.S., and 2 more between Britain and Canada. Because of its dependence on good radio conditions, this is estimated to be no more than 60 percent efficient. Under the new

system, there will be 29 telephone circuits to the U.S. and 6 to Canada—also some additional ones to Canada for telegraph purposes. Since there will be no atmospheric interference, 100 percent efficiency is expected.

That there is an urgent need for improved and enlarged facilities is shown by the increase in the number of transatlantic calls: in 1927, 2000; in 1951, approximately 100,000. The project probably will take about 3 yr to complete, and will cost $35 million—50 percent to be borne by the U.S., 41 percent by Britain, and 9 percent by Canada.

The National Geographic Society and California Institute of Technology have announced that the first section of an **atlas of the universe**, 6 yr in the making at Palomar Observatory, will be published in 1955. To be issued in three of four annual sections, the atlas fulfills a task assumed by the National Geographic Society-Palomar Sky Survey in 1949. By its very nature, the atlas will be one of the most expensive ever produced. Its price, covering only publication costs, is expected to be between $1600 and $2000 per copy, depending upon the number of advance subscribers. Necessarily these will constitute a limited list—perhaps not more than 100 universities, observatories, and other institutions.

The work will include a total of 1758 photographs, each 14 by 14 in., covering all the sky visible from Palomar Mountain—about three-quarters of the entire sky. Negative prints on double-weight photographic paper will be precise copies of the original glass plates exposed with the Schmidt telescope. This instrument penetrates the heavens to a depth of more than 500 million light-years, or 3×10^{21} mi. Each print covers an area about as large as the bowl of the Big Dipper and slightly overlaps adjoining areas. Also, each area is photographed twice, on blue-sensitive and red-sensitive plates in immediate succession. Only one printing of the atlas is planned. It will be confined to the number of copies for which orders have been received by the Mount Wilson and Palomar Observatories, Pasadena, Calif., *before Oct. 1, 1954.*

A new **electronic machine to aid in cancer research** has been designed by two Swedish scientists, Holger Hydén and Sven Bourghardt, both professors at the Medical College of Gothenburg. With it, structures and internal changes of cells can be studied with greater precision than before. Thin shavings of cellular growth consisting of up to 200 cells are divided into 12,000 "control points," the machine measuring and tabulating every point. The entire process takes but 4 min. Grants from the Swedish Government and the Rockefeller Foundation have paid for the apparatus.

Yaws, dread tropical disease that until 1950 affected approximately one-third of the rural population of Haiti, reaching 50 percent of the inhabitants in some areas, has been all but wiped out by the Haitian Government in cooperation with the Pan American Sanitary Bureau, Regional Office of the World Health Organization, and with substantial assistance from the United Nations Childrens Fund. This establishes a **landmark in public health** annals. In 1949 the Haitian Government requested international help to combat yaws, a major public health problem at that time. The disease was then estimated to affect nearly 1 million Haitians, out of a population of a little more than 3 million, incapacitating many persons and causing untold suffering.

One injection of penicillin is sufficient to cure the disease or to render it noncontagious. In 1950 crews of Haitians were recruited into teams to cover the whole Republic, district by district and community by community, with house-to-house visits. By the end of 1953, 2,623,141 persons had been treated at a cost of 30 ct per capita. Observations in the southern region of Haiti, where the campaign was first initiated, show that less than 1 percent of the population now has contagious yaws. In the northern region, where the project was conducted entirely by means of the house-to-house campaign, yaws incidence is less than one-third of 1 percent. The disease has been practically eradicted in a once highly infected zone, demonstrating the practicality of the total eradication in other tropical areas of the world. Many millions still suffer from this disease in Africa, in Asia, and in the islands of the western Pacific. Because of the close etiological resemblance of syphilis to yaws, the experience in Haiti also points the way to the possibility of eradicating that disease.

The Cooperative Research Foundation is establishing 11 **international science centers** in the United States to serve visiting scientists and engineers, and to stimulate direct working relationships between U.S. scientists and their colleagues in other parts of the world. The first of these centers was opened recently in San Francisco, and there will soon be a second in New York City. Scientists visiting the San Francisco Bay region are invited to call at the Center, Morrison Planetarium, California Academy of Sciences, Golden Gate Park.

The Armed Forces Institute of Pathology will collaborate with a group of Japanese pathologists headed by Toru Miyaji, professor of pathology at the Osaka University Medical School, in preparing a **Japanese textbook on histopathology.** The AFIP will contribute approximately 300 standard photomicrographs of typical pathologic states of various diseases.

Clara Raven, a lieutenant colonel and the Army's highest ranking woman physician on active duty, will select the illustrative material for the book and will write the legends for the prints as well as a part of the text. She was associated with the National Japanese Pathological Society and Japanese pathologists during her tour of duty in the Far East, 1951–53. Dr. Miyaji recently spent 3 yr on a fellowship at the University of Chicago and at the National Institutes of Health in Bethesda.

The 1954 expedition of the American Geographical Society—supported by the Office of Naval Research,

the Army, and the Air Force—has left for Lemon Creek Glacier in Alaska to study relations between **weather and the movement of glaciers.** Seven scientists, led by Edward R. LaChapelle of the U.S. Forest Service and Richard C. Hubley from the University of Washington, will study the glacier's present state and past history in an effort to predict whether or not this and other glaciers in the area will recede or advance in the future. Until last summer, no observations had been made of Lemon Creek, which is now receding as are all but a few of the world's glaciers.

A 3-yr study of **land and resources use in the American tropics** will be undertaken by the Instituto Mexicano de Recursos Naturales Renovables, A.C., in cooperation with the Charles Lathrop Pack Forestry Foundation of Washington, D.C. It will be headed by the director of the Instituto, Enrique Beltrán. The purpose of the study is to determine the effect of generations of human use on the natural resources, with the hope of learning what patterns of use may lead to better methods of soil and resource conservation.

The Peninsula of Yucatan, in Mexico, has been selected as the site for the work, which will be conducted by teams of Mexican and North American experts chosen from many disciplines in order to secure an integrated viewpoint. So far as is known, this is the first study of its kind ever made in the American tropics, and the techniques that are developed will in themselves constitute a research project. The Instituto and the Foundation officials hope that both in methods and results the study may serve as a guide for future population-resource projects in the tropics.

Scientists in the News

Edgar Anderson, formerly assistant director of the Missouri Botanical Garden, St. Louis, has been appointed director to succeed **George T. Moore,** now emeritus director, who held the position from 1912 until February 1953. Dr. Anderson will continue as professor of botany at Washington University. **Hugh Carson Cutler,** who has been serving as curator of the Garden's Museum of Economic Plants, will become assistant director.

Lester R. Aronson, chairman of the department of animal behavior of the American Museum of Natural History, has recently returned from Nigeria, where he spent a year studying the West African mouthbreeding fish in its natural environment. His trip was sponsored by the Fulbright exchange program.

Woolford B. Baker, professor of biology at Emory University, recently received a $100 meritorious teaching award from the Association of Southeastern Biologists.

Robert W. Berliner, has been appointed associate director in charge of research at the National Heart Institute, National Institutes of Health, U.S. Department of Health, Education, and Welfare. Dr. Berliner will occupy the position formerly held by **James A. Shannon,** who now is associate director of NIH.

Charles C. Bramble, former director of research at the Naval Proving Ground, Dahlgren, Va., has been appointed to the technical staff of the Research and Development Division, Norden Laboratories Corp., White Plains, N.Y., and Milford, Conn.

Vincent du Vigneaud, chairman of the Department of Biochemistry in the Cornell University Medical College, recently presented the 1954 Remsen memorial lecture of the American Chemical Society's Maryland Section in Remsen Hall, on the Homewood campus of The Johns Hopkins University.

Harold Elishewitz, assistant professor of parasitology at the Chicago Medical School, was recently elected a fellow of the Société Pathologie Exotique, Paris.

William Esty has been appointed research administrator of the Dickinson Research Memorial of the Planned Parenthood Federation of America. He succeeds **Paul S. Henshaw.**

Clifford C. Furnas, director of the Cornell Aeronautical Laboratory, is the new Chancellor of the University of Buffalo, effective Sept. 1. Dr. Furnas replaces T. R. McConnell, who on Feb. 1. announced that he would resign to conduct a survey of higher education in California and to become a professor of higher education at the University of California.

Marion A. Johnson, chairman of the Botany Department in the College of Arts and Sciences, Rutgers University, has been named dean of the Graduate School, effective July 1. He succeeds the late **Walter C. Russell.** Dr. Johnson will be relieved of all undergraduate teaching and administrative chores within the Department of Botany but will continue graduate teaching and research.

Thomas F. Keliher, clinical associate professor of medicine at the Georgetown University Medical Center, has received the Bene Merenti medal, the university's annual award of merit.

Arnold J. Kremen, associate professor of surgery at the University of Minnesota, has been appointed chief of the surgical service in the Francis Delafield Cancer Hospital in New York and professor of surgery in the Columbia University College of Physicians and Surgeons, effective July 1. He also will serve as attending surgeon at Presbyterian Hospital in New York City; both the Delafield and Presbyterian hospitals are units of the Columbia-Presbyterian Medical Center.

Ralph A. Lamm has been appointed technical director the Naval Ordnance Laboratory, Corona, Calif., succeeding **R. D. Huntoon,** who is now associate director for physics at the National Bureau of Standards in Washington. Other promotions at NOL-Corona in-

clude the designation of four division chiefs: **H. K. Skramstad,** missile systems division; **F. S. Atchison,** physical science division; **H. A. Thomas,** fuse division; and **G. R. Sams,** missile evaluation division.

N. F. Mott, Henry Overton Wills professor of physics and director of the Henry Herbert Wills Physical Laboratories at Bristol University in England, has succeeded Sir Lawrence Bragg as Cavendish professor of experimental physics at Cambridge. Sir Lawrence is now director of the Royal Institution.

Nine American engineers have been selected to work in India during the next 2 yr under a Foreign Operations Administration contract between the University of Wisconsin and the governments of the United States and India. The men and their destinations are as follows, with the first five named coming from the University of Wisconsin: **James R. Villemonte,** civil engineering, hydraulic engineering at Bengal Engineering College of Sibpur, West Bengal; **Gerard A. Rohlich,** civil engineering, municipal engineering at Roorkee University, Roorkee; **R. R. Benedict,** electrical engineering, Bengal Engineering College; **Vincent C. Rideout,** electrical engineering, communications engineering at the Indian Institute of Science at Bangalore, Mysore; **Gerald Pickett,** mechanics, Bengal Engineering College; **John C. Georgian,** mechanical engineering, Washington University, Bengal Engineering College; **Thomas L. Hansen,** architecture and city planning, University of Colorado, Bengal Engineering College; **Clarence H. Kent,** mechanical engineering, City College of New York, Indian Institute of Science; **Harold L. Walker,** mining and metallurgical engineering, formerly on faculty at the University of Illinois and now a consulting engineer, Indian Institute of Science.

This group is leaving the country during the current month; seven selections for the second year of the project will be announced later.

George Stafford Whitby, director of rubber research at the University of Akron, is to receive the 1954 Charles Goodyear Medal next September at the 126th national meeting of the American Chemical Society in New York.

Education

In response to a growing demand for increased part-time engineering training, a full undergraduate course of study leading to a B.S. degree in industrial and management engineering will be given at night at **Columbia University School of Engineering,** starting with the 1954–55 academic year. While the School of Engineering has been offering graduate work at night for several years, the industrial and management engineering curriculum is the first such program to be offered on an undergraduate level.

The long-range development of **Cornell University** will progress this year through a $22,000,000 building program. The largest in the institution's history, the program involves 10 building projects and affects the campus and Cornell's chief off-campus centers in Buffalo, Geneva, and New York. Both the privately endowed divisions and the state-supported contract units are included.

The biggest of the Ithaca projects will provide a modern laboratory-teaching center for the Veterinary College. Financed by legislative appropriation, the $5,500,000 installation will consist of 19 new buildings, scheduled for completion in 1956. Six dormitories will also be built at a cost of $4,200,000.

At the Cornell Aeronautical Laboratory in Buffalo, work will begin soon on a $1,750,000 addition that will virtually double the laboratory-owned space.

At the Cornell Medical College in New York, a $2,250,000 student residence is nearing completion.

In Geneva, plans are under way for a $1,800,000 food science laboratory for the Cornell-operated State Agricultural Experiment Station.

The **Institute for Numerical Analysis,** operated on the Los Angeles campus of the University of California for the past 6 yr by the U.S. Bureau of Standards, is being transferred to the University. All facilities of the Institute, including SWAC, the half-million dollar "electronic brain," will be lent to the University. The research staff will join the University's staff. The Institute will be administered by U.C.L.A.'s mathematics department under the direction of Magnus R. Hestenes. It will continue to receive governmental support through contracts with the Office of Naval Research and perhaps other agencies.

The mission of the organization is pertinent fundamental research in mathematics and science, including development and application of high-speed computers for such research. The Institute was established on the Los Angeles campus in 1947. Since that time it has been an aid to research and industry in the West, handling urgent computational problems in such diverse fields as aircraft design, weather, nuclear physics, and gunfire control.

The University of Pennsylvania's new **Institute of Neurological Sciences** is to be administered by a staff of six members of the School of Medicine. Louis B. Flexner, professor and chairman of the Department of Anatomy, has been named director, and his associates include John R. Brobeck, professor and chairman of the Department of Physiology; William W. Chambers, associate professor of anatomy; James M. Sprague, associate professor of anatomy; Eliot R. Stellar, associate professor of physiological psychology, and Per-Olof Therman, assistant professor of neurophysiology in psychiatry. Consulting members of the Institute include a group of 17 physicians who are members of the faculty of the medical school and college.

An educational and research **laboratory in oil hydraulics** has been established at Illinois Institute of Technology. It offers a broad educational program ranging from intensive short courses (the first of these will be given this summer) to graduate-level

research. Equipment for the laboratory has been donated by companies in the hydraulics field.

Some 300 acres of the Valhalla, N.Y., property of the John A. Hartford Foundation, has been leased to the **Yale University School of Forestry** for a new program of research and education in forest biology. The Foundation, founded by the late John A. Hartford who was President of the Great Atlantic & Pacific Tea Co., will also support the project with annual grants to Yale for the next 15 yr. The grants will be used to add nine new scientists to the forestry faculty, and to provide for research and training of graduate students. Headquarters for the research section will be at Valhalla, while the instructional program will be in New Haven, where the School of Forestry will take over additional quarters in Marsh Hall.

Grants and Fellowships

Applications for research awards to be made during the coming year by the **American Heart Association** and its affiliates throughout the country are now being accepted. Applications for research fellowships and established investigatorships may be filed until *Sept. 15*, and applications for research grants-in-aid will be accepted until *Dec. 1*. Information and forms may be obtained from the Medical Director, American Heart Association, 44 E. 23rd St., New York 10.

The research awards will be available for studies to be conducted during the year beginning July 1, 1955. Funds to support the research program are provided by the 1954 Heart Fund campaign conducted by the Heart Association and its affiliated associations and chapters. Established investigatorships, awarded for one to five-year periods subject to annual review, range from $6000 to $9000. They are available to scientists of proved ability who are engaged in a research career. Research fellowships, awarded for one or two-year periods, range from $3500 to $5500 and enable younger scientists to train for research careers under experienced supervision. Grants-in-aid are awarded in varying amounts, usually not exceeding $10,000, for periods of one to three years, to experienced scientists working in nonprofit institutions on specified programs of research.

The **Arthritis and Rheumatism Foundation,** New York, has awarded 20 basic research fellowships totaling $109,400 and representing a 17-percent increase over the previous year's allocations. The awards include, for the first time, two 5-yr senior fellowships.

Five-year senior fellowships

W. E. Reynolds, Harvard University Medical School. Measurement and prediction of the clinical course of rheumatoid arthritis.

M. Ziff, New York University College of Medicine. Changes in connective tissues in the rheumatic diseases.

Fellowship awards for 1954

R. H. Abeles, Dept. of Biochemistry, University of Colorado School of Medicine. Isotope effects in biological oxidation.

V. H. Auerbach, Biochemistry Dept., Harvard University Medical School. Regulation of amino-acid metabolism by adrenal cortical hormones.

T. A. Good, Lockhart Memorial Laboratory, University of Utah. Effects of anti-arthritic agents on production and blood levels of pituitary-adrenal hormones.

H. J. Gribets, New York University College of Medicine. Proteolysis of collagen in abnormal connective tissue; effect of streptokinase and streptodornase in arthritic joints.

G. D. Pappas, Dept. of Pathology, Yale University School of Medicine. *In vitro* effect of various biological compounds on collagen morphogenesis.

A. I. Snyder, Dept. of Medicine, College of Physicians and Surgeons, Columbia University. Effect of sympathetic denervation on inflammation and repair.

Renewals of 1953 fellowships

B. S. Blumberg, College of Physicians and Surgeons, Columbia University. Application of physical measurements to polydispersity and end groups of hyaluronic acid and chondroitin sulfuric acid.

C. W. Denko, Dept. of Medicine, University of Chicago. Connective tissue, cartilage and bone; metabolism and biochemistry, radioactive tracers; relation of diseased tissue to normal tissue metabolism.

T. G. Kantor, Pathology and Chemistry Laboratory, New York University—Bellevue Medical Center. Separation of acellular elements of tissues in various inflammatory states, characterization and possible modification.

D. Platt, Biochemistry Dept., University of Alabama Medical Center. Occurrence of mucopolysaccharides and glycoproteins in synovial fluid and their role in arthritis.

W. C. Robbins, Dept. of Medicine, New York Hospital—Cornell Medical Center. Experimental studies in rheumatic fever.

R. Rowen, Dept. of Microbiology, New York University College of Medicine. Nature and significance of inhibitory substance produced in mice in response to injection of streptolysin O.

A. Volkman, Western Reserve University School of Medicine. Factors in production of mucopolysaccharide deposits of Kimmelstiel-Wilson kidney, and diabetic retinopathy.

V. W. Westermeyer, Endocrine Laboratories, New England Center Hospital. Chemistry, physiology, and clinical effects of the growth hormone.

A. S. J. Dixon, Massachusetts General Hospital. Red cell mass in rheumatoid arthritis employing chromium 50 red cell tagging technique to measure cell mass and plasma simultaneously.

Renewals of 1952 fellowships

C. C. Coolbaugh, Dept. of Anatomy, Wayne University College of Medicine. Effects of reduced blood supply on bone.

J. W. Hahn, Rheumatic Fever Institute, Northwestern University. Physical and chemical characteristics of type-specific M- antigen of group A. streptococcus.

C. J. Imig, Dept. of Physiology, College of Medicine, University of Iowa. Circulation in skeletal muscle from experimental and clinical arthritic subjects.

The **Glycerine Producers' Association,** 295 Madison Ave., New York 17, has announced that **1954 Glycerine Research award nominations** for outstanding research involving glycerine are now being sought. These awards are made annually to recognize and encourage research leading to new and improved applications of glycerine or glycerine derivatives to products or processes. First award is a plaque and $1000; second, a certificate and $300; and third, a certificate and $200.

The work may concern itself with the chemical, physical, or physiological properties of glycerine, or with properties of glycerine-containing or glycerine-derived materials. It may deal with applications that of themselves are currently or potentially of value to industry or the general public, or with scientific principles or procedures likely to stimulate future applications. Originality in extending the application of glycerine into new fields of usefulness will receive special attention.

First consideration will be given to work brought to a successful conclusion or clear-cut point of accomplishment during the current year, regardless of the

date the work was initiated. Work carried on in previous years will be eligible if its significance has been confirmed by commercial application in 1954. The awards are open to any individual or research team in the United States and Canada that is not connected with member companies of the Glycerine Division, Association of American Soap & Glycerine Producers, Inc., on laboratories which they employ. *Nominations must be received by Nov. 1* and must be made on the official entry blank, which may be obtained from the Association.

The **Irwin Strasburger Memorial Medical Foundation** for medical research has been established in New York by members of the family and friends of Mr. Strasburger, a philanthropist who died last year. Initial grants totaling $5000 have been made to Memorial Hospital, New York Hospital, Columbia University College of Physicians and Surgeons, and Columbia University Research Division of Goldwater Memorial Hospital. The purpose of the Foundation is to promote clinical investigation and research concerning leading causes of disability and death, particularly those pertaining to cancer, migraine, arteriosclerosis, and diseases of the digestive tract.

The **Monsanto Chemical Co.** program of financial aid to scientific education for the 1954–55 academic year will benefit 44 American colleges and universities. There are 13 graduate fellowships, 27 undergraduate scholarships, and 17 cash grants. The fellowships have an average value of $3000, with the larger part of this amount going to the fellow; the scholarships are in amounts intended to cover tuition and are to be awarded by the administering schools on bases of both merit and need; and the grants may be used to finance research, equipment purchases, or other similar purposes.

These awards are one phase of Monsanto's over-all program of cooperation with scientific education. For instance, Monsanto's operating divisions support education through numerous grants for specific research, through faculty and student trainee programs, and by the donation of equipment and materials to schools.

The **National Science Foundation** will award individual grants to defray partial travel expenses for a limited number of scientists who will attend the **International Union of Pure and Applied Chemistry Symposia** on inorganic chemistry to be held in Muenster, Germany, Sept. 6–8, and on macromolecular chemistry to be held in Turin and Milan, Italy, Sept. 26–Oct. 2. Application blanks may be obtained from the National Science Foundation, Washington 25, D.C. *Completed forms must be submitted by July 15.*

The following scientific grants were awarded by the **Rockefeller Foundation** during the first quarter of 1954.

Karolinska Institut, Stockholm. T. Caspersson, Institute for Cell Research. Cellular studies at the molecular and electron microscopic level, 3 yr, $30,000.

Wayne University. C. Djerassi, Department of Chemistry. Natural products of one subtribe of cacti, 3 yr, $30,000.

University of London. J. T. Randall, King's College. Purchase of electron microscope and biophysics research, 2 yr, $24,000.

University of California, Berkeley. M. Calvin, Radiation Laboratory. Photosynthesis, 3 yr, $18,500.

Bacteriological Institute of Chile, Santiago. Equipment and supplies for Animal Virus Laboratory, $15,000.

Allahabad Agricultural Institute, India. Equipment, $12,000.

Medical Research Council of Great Britain. Fellowships in medical sciences, $125,000.

National Institute of Cardiology, Mexico City. Support of laboratories of physiology and pharmacology, $50,000.

University of Aix-Marseilles, France. G. Morin. Equipment for research in neurophysiology, 2 yr, $30,000.

Health Insurance Plan of Greater New York. L. J. Reed. Study and report of recorded experience of the plan, $20,500.

University of Puerto Rico. Books for School of Medicine library, $25,000.

University of Oslo. C. Semb, Institute of Respiratory Physiology. Measurement of respiratory gaseous exchange; teaching of clinical physiology, 4 yr, $32,000.

Uusimaa Field Demonstration and Teaching Area, Finland. Support of teaching staff, 3 yr, $32,000.

University of Geneva. Institute of Human Genetics. Central register for recording hereditary diseases, 3 yr, $10,000.

University College, Dublin. E. J. Conway, Process of accumulation and exchange of inorganic ions in cells and tissues, 3 yr, $12,000.

Roscoe B. Jackson Memorial Laboratory. Survey of financial structure and support of symposium on relationships of genetics to normal and abnormal growth and behavior, $10,000.

New York Botanical Garden. Purchase of recording spectrophotometer, $8500.

Child Research Center of Michigan. Pilot study of the genetics of blood disorders in Africa, $5200.

Tufts College. G. Schmidt. Nucleic acid chemistry, $3000.

Woods Hole Oceanographic Institution. S. Turner. Meteorological research in the Hawaiian Islands, $2500.

Pennsylvania State University. R. Pepinsky. Visit to European research centers, $2000.

University of Michigan Hospital. D. C. Smith, Department of Pediatrics. Observation of methods of teaching maternal and child health in U.S., $1400.

U.S. Public Health Service. B. D. Davis. Observation of new techniques in research in protein synthesis at the Pasteur Institute, Paris, $1000.

Department of Health, Province of Saskatchewan. A. Hoffer, director of psychiatric research. Visit to psychiatric centers in Great Britain, Scandinavia, and other parts of Europe, $2700.

McGill University. R. Chittick, School for Graduate Nurses. Visit to university nursing schools in U.S., $1000.

National Health Service of Denmark. M. Foget, director of nursing education. Visit to university schools of nursing in U.S. and Canada, $3150.

University of Copenhagen. M. G. Kolmark. Visit to U.S. centers of research in genetics, $500.

University of Turku, Finland. E. Mustakallio, Faculty of Medicine. Visit to medical centers in U.S. and Canada, $2650.

University of Helsinki. Institute of Sero-Bacteriology. Purchase of library equipment, $1500.

Rheinische Friedrich-Wilhelms-Universität, Bonn. E. Hagen, Institute of Anatomy. Research, $6150.

University of Pavia, Italy. V. Zambotti, Institute of Biological Chemistry. Equipment for biochemical research, $5000.

University of Pavia. Institute of Comparative Anatomy. Equipment for research on spectroscopic biology, $3500.

University of Palermo. G. Reverberi, Institute of Zoology. Equipment for research in cytology and embryology, $5000.

University of Rome. Laboratories of Comparative Anatomy and of Embryology and Histology. Experimental biology, $4000.

University of Pisa. M. Benazzi, Institute of Zoology and Comparative Anatomy. Genetics and embryology, $3500.

University of Bologna. P. Pasquini, Institute of Comparative Anatomy. Embryology, $2500.

University of Bologna. L. Raunich, Institute of Comparative Anatomy. Visit to Switzerland for studies in steroid chemistry, $700.

University of Milan. C. Barigozzi, Institute of Genetics. Equipment for research in genetics, $700.

University of Padua. G. Marcuzzi, Institute of Zoology and Comparative Anatomy. Visit to England, $570.

University of Amsterdam. C. H. MacGillavry, Laboratory of General and Inorganic Chemistry. Equipment for research in x-ray crystallography, $1500.

Karolinska Institut, Stockholm. E. K. H. Kugelberg, Dept. of Clinical Neurophysiology. Visit to neurological and neurophysiological centers in U.S. and Canada, $1950.

University of Geneva. E. Kellenberger, Institute of Physics. Visit to European countries, $550.

University of London. D. M. MacKay, King's College. Electrophysiology, $8000.

University of London. H. J. Eysenck, Institute of Psychiatry. Visit to psychology research centers in U.S. and Canada, $2700.

University of Glasgow. M. B. Swann, Dept. of Psychological Medicine. Visit to psychiatric social work centers in U.S. and Canada, $2400.

University of London. J. R. Ellis, London Hospital Medical College. Visit to medical schools in U.S., $2150.

Royal Technical College, Glasgow. A. S. T. Thomson. Visit to sanitary engineering centers in U.S., $1650.

London School of Economics and Political Science. H. T. Himmelweit. Visit to social and clinical psychology centers in U.S., $1150.

University College of North Wales. F. W. R. Brambell. Visit to U.S. and participation in Cold Spring Harbor Symposium, $1150.

University of Liverpool. Visit of foreign delegates to symposium in Liverpool, $1500.

University of Oxford. F. P. Glees, Laboratory of Physiology. Visit to neurophysiological research laboratories in U.S., $800.

University of Leeds. I. Manton, Dept. of Botany. Visit to U.S. to study uses of electron microscopy, $700.

University of Aberdeen. J. Walker, Dept. of Obstetrics. Visit to laboratories of obstetric medicine research in U.S., $400.

Nilratan Sircar Medical College, Calcutta. A. K. Basu. Equipment for thoracic surgery, $4600.

Department of Health, Accra, West Africa. E. Akwei. Visit to several countries to observe medical and health services, $2850.

Keio University, Tokyo. T. Miura, Medical School. Visit to observe teaching of psychiatry in U.S. and Canada, $3850.

Hacienda San Ignacio, Cochabamba, Bolivia. L. Lujan. Visit to Colombian Agricultural Program for potato research, $1485.

Institute of Agronomy, Campinas, Brazil. M. Itto. Visit to U.S. centers of research in bean breeding, $890.

University of Chile. J. Allamand, School of Medicine. Visit to medical centers in U.S. and Canada, $3050.

University of Costa Rica. Equipment for School of Agriculture, $10,000.

University of Mexico. J. Laguna, Medical School. Visit to medical centers in U.S. and Canada, $1450.

University of Guanajuato, León, Mexico. F. G. Guerra, Dept. of Thoracic Surgery. Visit to medical centers in U.S. and Canada, $1500.

University of Guadalajara, Mexico. Equipment for Dept. of Biochemistry, $10,000.

Mexican Agricultural Program. Exchange of seeds and information; travel expenses for visiting scientists, $5000.

Ministry of Agriculture, Peru. H. P. Smith, National Inst. of Animal Biology. Visit to U.S. centers of research on animal diseases, $2450.

Institute of Biological Research, Montevideo. *Drosophila* genetics and histochemistry, $800.

Institute of Biological Research, Montevideo. A. V. Ferreira. Visit to U.S. for meeting of American Association of Anatomists, $600.

Meetings and Elections

The **9th Annual Calorimetry Conference** is scheduled to meet at the General Electric Research Laboratory, Schenectady, N.Y., Sept. 17–18. As in the past, this meeting will serve to bring together scientists—chemists, metallurgists, physicists, and others—who utilize the various methods and techniques of calorimetry. The purpose of the conference, as first founded and organized by the late Hugh M. Huffman, is to promote better calorimetry by informal discussion of mutual problems, by an exchange of ideas, and by presentation of new experimental techniques. The conference will be devoted in part to such topics as: very low temperature calorimetry; liquid helium calorimetry; high and low temperature adiabatic calorimetry; measurement of stored energy in solids and related topics; high precision bomb calorimetry; and measurement of heats of solutions and heats of precipitation, both for liquid-solid and solid-solid transformation. In addition, the conference will concern itself with standard calorimetric samples, symbols and terminology, promotion of better instrumentation, and publication policies pertinent to thermodynamic data. The various topics may be presented as individual reports, as round table discussions, or as committee reports.

The G-E Research Laboratory, Engineering Laboratory, and Turbine Laboratory will be open to members of the conference for visits.

Chairman of the 1954 meeting is E. J. Prosen of the National Bureau of Standards, and the program chairman is Warren DeSorbo of the G-E Research Laboratory. Members of the Board of Directors, in addition to Prosen and DeSorbo, are E. F. Westrum, Jr., J. W. Stout, Guy Waddington, and D. R. Stull.

Program plans for the 45th annual meeting of the **American Home Economics Association** scheduled for July 6–9 in San Francisco are now complete. Theme of the meeting is "Today's challenge to the home economist." For information write to the Association at 1600 20th St., NW, Washington 9, D.C.

The **American Institute of Chemists** has elected the following officers: pres., Donald B. Keyes, Arthur D. Little Co., New York; pres.-elect, Ray P. Dinsmore, Goodyear Tire & Rubber Co., Akron, Ohio; sec., Lloyd Van Doren, Watson, Leavenworth, Kelton & Taggart, New York; treas., Frederick A. Hessel, General Aniline & Film Corp., New York.

The **Industrial Research Institute** has elected the following officers: pres., Howard G. Vesper, Standard Oil Co. of California; v. pres., E. D. Reeves, Standard Oil Development Co., New York.

The UNESCO Advisory Committee on Arid Zone Research officially sponsors an arid lands conference in even-numbered years and encourages the development of sessions under other auspices in odd-numbered years. The 1954 UNESCO Conference will be held in New Delhi, India, in October and will consider solar and wind energy problems. The Committee on Desert and Arid Zone Research of the Southwestern and Rocky Mountain Division of the AAAS, through its chairman, Peter Duisberg, suggested an **international arid lands symposium and conference** to be held in the Southwest in 1955. The suggestion and the tentative outline were considered by the UNESCO Advisory Committee at its Paris meeting, May 4–7. The UNESCO group agreed to cooperate, scheduled a committee meeting for the same time and place—tentatively, Albuquerque and Socorro, N.M., Apr. 27–May 2, 1955—and recommended a subsidy from UNESCO to assist in bringing foreign delegates to the meeting. The AAAS Board of Directors recently approved official sponsorship of the proposed symposium and conference and authorized the establishment of a planning committee.

The Southwestern and Rocky Mountain Division, host for the meetings, has set up a committee to assist the national committee that has worked out tentative plans and ideas for the symposium. The Division will hold its regular meeting in Santa Fe, Apr. 24–26, 1955. The international symposium on arid land problems will be scheduled for Apr. 27–28 in Albuquerque, with the University of New Mexico serving as host in behalf of the Division. The symposium will be open to all interested persons (an estimated 500 to 1000 attendance) and will include among its speakers and discussants distinguished workers in the arid zone fields from the U.S. and abroad. The papers and the discussions will probably be published in book form either by the AAAS or by UNESCO.

Following the symposium the official participants, a group of 30 to 50 including the nine members of the UNESCO Advisory Committee, will spend several days in a conference as guests of the New Mexico Institute of Mining and Technology at Socorro.

The Executive Committee of the Division has suggested a program for the symposium composed of four parts, each a half day long, covering (i) Anthropology and Archaeology; (ii) Biology and Ecology; (iii) Meteorology and Climatology; and (iv) Geology, Hydrology, and Soils. Suggestions for the Symposium and Conference will be welcome and should be transmitted immediately to Dr. Gilbert F. White, Haverford College, Haverford, Pa.

The 6th **International Astrophysical Symposium** organized by the Institut d'Astrophysique of Liège, Belgium, will take place July 15–17 under the chairmanship of Otto Struve. The subject this year is "Solid particles in astronomical objects."

The 2nd annual meeting of the **Inter-Society Cytology Council** will be held in Boston, Nov. 12–13. Those having material to present are invited to submit three copies of an informative abstract of not more than 200 words to Dr. John B. Graham, 32 Fruit St., Boston, Mass., *before July 15*. Authors will be notified of acceptance by Sept. 30. Abstracts of all papers accepted will be published in the official program. Papers will be limited to 15 min. They will be discussed in related groups rather than individually, and a maximum of eight papers will be presented at each session.

The diagnostic accuracy in cancer of the cervix and the lung is so well established that further verification at this meeting is not indicated. Particular attention is suggested for the endometrium and lesions of the gastrointestinal and urinary tract."

The scientific program will comprise four consecutive sessions: (i) "Special techniques, including cytochemistry, ultraviolet and electron microscopy" and "General cytology," chairman, James W. Reagan. (ii) "Prognosis in the treatment of cancer by cytologic and histologic techniques," chairman, Arthur T. Hertig; (iii) "New developments in cytology," chairman, Emerson Day; (iv) "Round table discussion of the carcinoma *in-situ* lesion," chairman, John R. McDonald.

Registration will be open to everyone interested in cytology. Medical students, internes, and residents will be admitted without charge. For additional information write to the Secretary-Treasurer, Inter-Society Cytology Council, 634 North Grand Blvd., St. Louis, Mo.

The **Michigan Academy of Science, Arts, and Letters** has elected these officers for 1954–55: pres., Frederick K. Sparrow, Jr., University of Michigan; v. pres., Willard E. Parsons, Wayne University; sec., Pierre Dansereau, University of Michigan; treas., Volney H. Jones, University of Michigan.

The **Mineralogical Society of Japan** has been established with Zyunpei Harada of Hokkaido University, Sapporo, as president. Two series of publications are the organs of the Society: *Kobutsugaku Zasshi* (Journal of the Mineralogical Society of Japan) and *Mineralogical Journal*. The Society earnestly desires to cooperate with colleagues the world over for the advancement of mineralogy.

The annual meeting of the **North Carolina Academy of Science** was held at East Carolina College, Greenville, May 7–8. Some 300 persons participated; 77 papers were presented. The Collegiate Academy had a program of 11 papers; in addition there was a high school exhibit and essay contests.

The presidential address was delivered by D. B. Anderson of North Carolina State College. New officers are as follows: pres., W. O. Puckett, Davidson College; v. pres., A. D. Shaftesbury, Woman's College, University of North Carolina.

The recent British Institute of Physics 4-day conference on the **"Physics of particle size analysis"** was attended by approximately 300 people, including several from overseas. The meeting was opened by Sir Geoffrey Taylor. The many original papers presented reflected the considerable and growing importance of the subject in industry and in its applications to medicine. Recent developments in automatized methods of counting and sizing particles, including blood counts, were of special interest at the conference, and these discussions were supplemented by demonstrations of several new machines.

Other aspects covered included the motion of particles in fluids and a comparison of sedimentation methods for particle-size analysis. Molecular phenomena encountered in the relative motion of fluid and fine particles—such as slip flow, surface diffusion, and electro-viscosity—also received consideration. Recent theoretical and experimental studies of the scattering and absorption of light by particles formed a valuable background in the study of photo-extinction and similar methods. Consideration was also given to the practical issues of particle shape factors and visual counting and sizing with a microscope. The conference concluded with a general discussion, including comparison of methods of size analysis and the adhesion of dust particles.

The papers presented at the conference and the discussion on them are being published by the Institute as a supplement to its *British Journal of Applied Physics*. Copies may be ordered through any bookseller or direct from the Institute of Physics, 47 Belgrave Square, London, S.W. 1.

Mount Desert Island Biological Laboratory, Salisbury Cove, Me., and New York University College of Medicine will hold an informal symposium on **"Protoplasmic structure and cellular transport mechanisms"** on Aug. 23–25 in Salisbury Cove. Homer W. Smith, president of the Laboratory will preside. The program will feature presentations by Hans Ussing of the Zoophysiological Laboratory, Department of Biological Isotope Research, University of Copenhagen, and Johannes Rhodin of the Department of Anatomy, Karolinska Institutet, Stockholm. Prof. Ussing will speak on cellular transport mechanisms, and Dr. Rhodin will speak on the electromicroscopy of the renal tubule. Protoplasmic structures and cellular transport mechanisms will be discussed by other participants. All visitors are invited to bring lantern slides and similar material for consideration.

The Laboratory will be happy to assist in securing reservations for scientists and their families who plan to attend. Correspondence should be addressed to the director, Dr. Warner F. Sheldon. Prof. Ussing and Dr. Rhodin will be in residence at Salisbury Cove from Aug. 1–31, and will be available, with other investigators, for informal conferences.

Officers of the **Society of Rheology** for 1954–55 are: pres., W. H. Markwood, Jr.; 1st v. pres., F. D. Dexter; 2nd v. pres., J. H. Dillon; sec.-treas, W. R. Willets.

The **7th World Health Assembly** has elected as president Joseph Nagbe Togba, Director of Public Health and Sanitation of Liberia. Vice-chairmen elected are Youssef Bauji, Lebanon; Sir Claude Corea, Ceylon; and Public Health Ambassador Felix Hurtado, Cuba. E. J. Aujaleu of France is chairman of the Committee on Program and Budget, responsible for the examination of the work of WHO in 1953 and for establishment of the program and budget for 1955. M. Jafar of Pakistan is chairman of the Committee on Administration, Finance and Legal matters.

Miscellaneous

An invitation to attend the **First International Instrument Congress and Exposition** at Philadelphia in September has been extended to scientists and engineers of 32 foreign countries by William A. Wildhack of the National Bureau of Standards and president of the Instrument Society of America. Special invitations prepared for distribution to foreign countries through their embassies have been printed in French, German, Portuguese, and Spanish. Members of the Society who desire to send individual invitations abroad may have copies for their use.

The **International Union for the Protection of Nature** is building up a "bank" of articles by specialists and technicians on one or another aspect of nature protection. These will be put at the disposal of any periodical that wishes to publish them. The articles will be given freely in each country to the first applicant to the Secretariat of the Union, 42 rue Montoyer, Brussels, Belgium. Articles available will be listed and described briefly in the IUPN Information Bulletin.

The New York Section of the American Chemical Society will accept contributions for a bust of **Josiah Willard Gibbs** that is to be placed in New York University's Hall of Fame. The memory of Willard Gibbs (1839–1903), Yale University professor of mathematical physics for 32 yr and one of the greatest of American scientists, was honored by New York University in 1950 by his election to the Hall of Fame. However, despite generous contributions by the National Academy of Sciences, the AAAS, the American Philosophical Society, the American Academy of Arts and Sciences, and private sources, $5900 of additional funds will be necessary to have a bust created and installed. The endowment of the Hall does not allow for these expenses, which will total some $8500. Ordinarily the funds are provided by the family, friends, or business associates of the honored person or by public subscription.

Results of 1953 Fungicide Tests, reprinted from a series of articles that appeared in *Agricultural Chemicals*, January through March, may be purchased in bound and covered form for $1.00 per copy by sending orders with remittance to Dr. W. D. Mills, Department of Plant Pathology, Department of Agriculture, Cornell University, Ithaca, N.Y. Sponsored by the American Phytopathology Society, it is a continuation of the publication of results formerly provided through a Supplement of the *Plant Disease Reporter*, Plant Disease Survey, U.S. Department of Agriculture.

The underwriting of this project was accomplished through contributions from many commercial companies identified with the pesticide industry. The Temporary Advisory Committee on Collecting and Disseminating Data on New Fungicide Tests of the American Phytopathological Society arranged for the recent publication of data and the establishment of a program for annual publications of fungicide test results in the future. Dr. D. A. Roberts, Dept. of Plant Pathology, Cornell University, is in charge of this project during the current year.

The New York Office of UNESCO has announced the following **science and engineering vacancies** in the technical assistance program: anthropologists, Rio de Janeiro, Brazil; sociologist, Rio de Janeiro; professor in industrial engineering and administration, Indian Institute of Technology, Kharagpur, India; expert in electronics instruments, National Physical Laboratory, Delhi, India; expert in irrigation engineering, Roorkee University, U.P., India.

Book Reviews

Advances in Veterinary Science, Vol. 1. C. A. Brandly and E. L. Jungherr, Eds. Academic Press, New York, 1953. 431 pp. Illus. $9.

This first volume of a proposed series on *Advances in Veterinary Science* consists of eight chapters: Animal Diseases and Human Welfare; Virus Diseases; Sulfonamides; Antibiotics; The Infertility Problem of Cattle; Bovine Mastitis; Swine Diseases; and Veterinary Public Health. The various chapters, written by experts in their respective fields, contain up-to-date information, documented by an exhaustive list of references. Some of the subject matter deals with progress and findings primarily in the veterinary field; other information pertains to public health and preventive medicine transcending the spheres of human and veterinary medicine. Thus the book will be of value to the veterinary practitioner, the researcher, and the public health worker.

The comprehensive reviews of the literature on sulfonamides and antibiotics contain the available information on dosages for the different animal species, the toxicology, and the susceptibility of various pathogens to the action of these therapeutic agents. Bovine mastitis is dealt with from the standpoint of etiology, diagnosis, prophylaxis, and therapy. Bacterial and viral infections of swine are discussed, with emphasis on the essential need for more adequate research and less reliance upon control by disposal of infected herds and replacement with new animals free of disease. There is a discussion of the methods of study of virus diseases, and a review of the more important virus infections of the different animal species. Infertility of cattle is analyzed from the standpoint of the effect of nutrition, heredity, endocrine imbalance, and infection.

The importance of animal diseases transmissible to man is properly stressed and the more common ones of the zoonoses are discussed. In addition, due significance is attached to the effect of animal losses in general upon human welfare by reducing the available world supply of animal products for human consumption. The cost of the more important diseases of livestock and poultry in the United States is tabulated, estimated at one and a half billion dollars annually. The ever increasing scope of veterinary public health from a national and international standpoint is well illustrated in a discussion of the activities in this field by such agencies as the United States Public Health Service, the Pan American Sanitary Bureau, and the World Health Organization.

It is gratifying to see the information contained in this volume made available to the veterinary profession, and to medical scientists in general. As stated in the Preface, ". . . the scope of veterinary science, together with the great expansion of study and research in the specialized fields, has produced a literature so comprehensive that no one can keep abreast of all advances." And by looking toward additional publications in this series, the editors anticipate that "by enlisting the efforts of different authorities on the same subject at succeeding periods, it is hoped to maintain a broad, but fluid, front line of modern knowledge." We shall eagerly look forward to the future volumes.

I. Live

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Sex Determination. ed. 3. F. A. E. Crew. Methuen, London; New York, Wiley, 1954. vii + 68 pp. $1.50.

This little book is sound, but its usefulness is limited. The reader who already has a fair knowledge of genetics and cytology will find little beyond the usual textbook treatment of the salient facts; the beginner would do better to start with a well illustrated treatment. Eight pages are devoted to *Lymantria dispar,* but plants are disposed of in a five-page chapter, along with fishes and *Paramecium.* Reference to the bibliography will not lead the reader directly to such pertinent papers as Warmke's "Sex determination and sex balance" in *Melandrium* (1946). The most valuable feature of the book is the historical thread which runs through most of it. Relegation of speculations to a final chapter, appropriately labelled, is commendable. There are 146 references, well chosen for the most part, and a 56-word glossary.

J. A. Weir

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The Physiology of Man. L. L. Langley and E. Cheraskin. McGraw-Hill, New York, 1954. 609 pp. Illus. $5.50.

This is a very unusual book in that it incorporates some of the better ideals of teaching in an elaboration of the principles of general, human physiology. *The Physiology of Man* is very well written, and the diagrams illustrating the text are original and very interestingly presented. Of further interest is the unique fashion in which many physiological concepts are presented as an integrated pattern throughout the entire book.

The authors state: "This book is dedicated to the proposition that learning can be fun." I share this thought wholeheartedly. Throughout the text, the authors have attempted to interdigitate some very humorous cartoons depicting the sequence of events associated with physiological expressions. This is certainly a measure of their originality and their down-to-earthness in textbook writing. Their clear, simple, picturesque style will gain considerable popularity for their book.

This book is divided into five parts: "The Nervous

System," "The Circulatory System," "The Respiratory System," "The Alimentary and Excretory Systems," and "The Endocrine System." Both Langley and Cheraskin demonstrate their pedagogic acumen by orienting the reader with nearly 12 pages of basic biological information prior to taking him on an enjoyable academic excursion in the fields of physiology. This serves to orient the student who is approaching his first course in physiology.

Every physiologist has his own way to present physiological facts. The authors, in their unique approach, elected to divorce the usual stockpile of facts from their textbook. In so doing, they present a general view of human physiology; they purposely omit the common disparities; and further, they lean with considerable force upon dogmatic statements. No doubt, some will disagree, while others will hasten to jump to their support. Those who disagree will likewise take sharp issue with them for their omission of all bibliographic references.

The Physiology of Man should be useful without too much restriction in the general education courses that are now in vogue. Further, it seems reasonable that this book should prove to be a worth-while companion for students in the nonlaboratory college courses in human physiology. Now that global events have made man more inquiring of the internal activity of his dynamic body, it seems reasonable to point to this new book as a palatable way in which to satiate man's immediate fulfillment of that desire.

In the final analysis, the methodology employed in the graphic presentation of physiological expressions in this book should be a guide to successful teaching of human physiology. Herein lies a multitude of examples for immediate incorporation into many general, human physiology courses.

JOSEPH T. VELARDO
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Silicified Middle Ordovician Trilobites. H. B. Whittington and W. R. Evitt, II. Geological Society of America, New York, 1953. 137 pp. Illus. + plates. $3.

Silicified fossils offer unequaled opportunities for studying structural details, because the specimens can be freed of the surrounding rock by chemical methods. Recent discoveries of silicified trilobites in early Paleozoic strata of the Great Basin and the Shenandoah Valley of Virginia have advanced our knowledge of these extinct arthropods. After several shorter publications, the authors now present an extensive monograph where 16 species from Virginia, distributed among 8 genera, are described and illustrated in detail. The preservation of the material is so excellent that probably little more could be learned about the exoskeleton of these 400-million-year-old organisms if we had the living animals before us. The authors have given a masterful treatment of the subject, including a study of development, besides the descriptions of the genera and species. It is obvious, even to the layman, that an essential feature of work of this type is adequate illustration. Also, in this respect the authors have done full justice to their material. Years of labor spent in preparing the delicate fossils and developing appropriate photographic techniques have produced splendid illustrations, many of which are stereograms portraying the full three-dimensional form of the objects. In addition to the photographic reproductions, restorations presented in line drawings give clear pictures of the aspect of the entire animals. The Geological Society of America is to be congratulated for the excellence of the photogravure reproductions and the typographic quality of the book as a whole.

This monograph of Whittington and Evitt sets such a high standard in paleontologic research that it will doubtless become a classic in trilobite literature. Aside from its value to the specialist, I believe that even the neozoologist interested in other fields could profitably read it—or at least glance at the wonderful photographs—if only to find out how much has been learned about these ancient dwellers of the seas through patient field and laboratory work.

The authors are now engaged in extending these studies, with special attention to the larval development which is becoming known for many silicified trilobites. In view of their past performance, further contributions are eagerly awaited by paleontologists.

FRANCO RASETTI
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Recent Progress in Hormone Research, Vol. VIII. Proceedings of the Laurentian Hormone Conference. Gregory Pincus, Ed. Academic Press, New York, 1953. 603 pp. Illus. $10.80.

The Laurentian Hormone Conference is seemingly a fixed feature on the endocrinological horizon, and the publication of their annual transactions is an event looked forward to with anticipation. Volume VIII, containing the proceedings of the 1952 meeting, which has recently made its somewhat belated appearance, is no exception. Excluding one or two, most of the papers represent consolidation of old gains rather than the establishment of new ones. This, however, detracts nothing from the value of the book and simply reflects the fact that endocrinology, like other sciences, occasionally has its quieter moments.

As always, the papers presented are broad in their scope and stimulating in their variety. There is something here for almost everyone, from the organic chemist to the practicing physician. Anyone professionally interested in endocrinology, whether as a teacher, investigator, or clinician, should have this volume, along with its companions, available for reading and reference. Taken all together, the series tells in a vivid, interesting, and authoritative fashion the story of endocrinology in recent years.

In the present volume, as in the others, the papers are grouped in several sections: I. Chemistry and Biochemistry of Adrenocorticosteroids; II. Adrenocortical Physiology—Symposium on Diseases of Adapta-

tion; III. Physiology of Reproduction; and IV. Growth Hormone and Metabolism. There are three to five papers in each section and of them all, Section I is the most highly technical and least likely to appeal to the general reader. I was most interested in Section II and grateful for the opportunity to sit on the sidelines, so to speak, and watch a new and, to be sure, incomplete concept of disease being hammered out in the discussion.

Some new advances are recorded, particularly in Sections III and IV. The paper on relaxin was welcome as well as stimulating, as was the discussion of the growth hormone and its possible relation to diabetes. Their inclusion was timely and added considerably to the value of the book. As a paper on fetal endocrinology was included in this volume, perhaps it is not too much to expect something on invertebrate endocrinology or comparative vertebrate endocrinology in the near future.

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Probability and Information Theory, with Applications to Radar. P. M. Woodward. McGraw-Hill, New York; Pergamon Press, London, 1953. 128 pp. Illus. $4.50.

This attractively printed and charmingly written little book lives up to the promise of its prefaces (editor's and author's), but the description on the dust cover is somewhat misleading, for, quoting the latter, "It is directed toward the reader who, without any highly advanced mathematical knowledge, wishes to link his practical intuition and experience with precise mathematical theory." Such a reader, if he has no knowledge of probability, complex variable, Fourier transforms, and advanced circuit theory, will capitulate early. The superior senior undergraduate in engineering or physics, the graduate student, and the specialist should enjoy this succinct treatment of the field.

The first chapter, on probability, discusses the basic concepts, Bernoulli's theorem, moments, generating functions, characteristic functions, the convolution integral, Poisson and normal distributions and entropy as a measure of spread—all this and more in 25 pages. Twenty pages cover wave-form analysis and noise (including Parseval's theorem and the sampling theorem); approximately the same space is devoted to information theory. The remaining four of the seven chapters deal with the statistical problem of reception, theory of radar reception, the mathematical analysis of radar information, and the transmitted radar signal. These are based, for the most part, on several articles by the author and I. L. Davies and will interest the specialist.

In my opinion, the book would benefit from (i) a more extensive bibliography (only nine references are given—none to Wiener and many other important contributors); (ii) inclusion of a discussion of important relevant topics, for example, filtering and prediction, which are touched on too briefly or entirely omitted; and (iii) more detailed development (the book would be short and still concise at twice its present length). It is to be hoped that the author will attempt this in a future edition, the more so as his expository skill is clearly high.

JEROME ROTHSTEIN
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New Books

Psychische Komponenten der Sinnesorgane. Eine Psychophusische Hypothese. Bernhard Rensch. Georg Thieme Verlag, Stuttgart, Germany, 1952. 200 pp. Illus. DM 22.50.

Soil and Fertilizer Phosphorus in Crop Nutrition. Agronomy Ser. Vol. IV. W. H. Pierre and A. G. Norman, Eds. Academic Press, New York, 1953. 492 pp. Illus. $9.

Elementary Introduction to Molecular Spectra. Børge Bak. North-Holland, Amsterdam; Interscience, New York, 1954. 125 pp. Illus.

Organic Chemistry. A brief course. Robert Ward Getchell. McGraw-Hill, New York, 1954. 278 pp. $4.

Soft Magnetic Materials for Telecommunications. A symposium held at the Post Office Engineering Research Station in April, 1952. C. E. Richards and A. C. Lynch, Eds. Interscience, New York; Pergamon Press, London, 1953. 346 pp. Illus. + plates. $9.

An Introduction to Laboratory Technique in Bacteriology. ed. 3. Max Levine. Macmillan, New York, 1954. 413 pp. Illus. + plate. $4.50.

Television Receiver Design. Monograph 2. Flywheel Synchronization of Saw-tooth Generators. Electronic Valves, Book VIIIB. P. A. Neeteson. Philips' Technical Library, Eindhoven, Netherlands, 1953. U.S. distr.: Elsevier Press, Houston. 156 pp. Illus.

Connective Tissues. Transactions of the Fourth Conference, Feb. 18–20, 1953. Charles Ragan, Ed. Josiah Macy, Jr. Foundation, New York, 1953. 197 pp. Illus. $3.75.

Complex Variable Theory and Transform Calculus. ed. 2. With technical applications. N. W. McLachland. Cambridge Univ. Press, New York, 1953. 388 pp. Illus. $10.

Il Cancro: Cause e meccanismo delle proliferazioni. Vol. I. Camillo Brioschi Editore, Milan, 1953. 421 pp.

Il Cancro: Biologia del tessuto neoplastico. Vol. II. Camillo Brioschi Editore, Milan, 1953. 743 pp.

Soils and Fertilizers. ed. 4. Firman E. Bear. Wiley, New York; Chapman & Hall, London, 1953. 420 pp. Illus. $6.

Biochemistry and Physiology of Nutrition, Vol. I. Geoffrey H. Bourne and George W. Kidder, Eds. Academic Press, New York, 1953. 569 pp. Illus. $13.

Renal Function. Transactions of the Fourth Conference, Oct. 22–24, 1952. Stanley E. Bradley, Ed. Josiah Macy, Jr. Foundation, New York, 1953. 189 pp. Illus. $3.50.

Bakteriologische Nahrboden. Ausgewahlte Nahrbodenrezepturen fur das Medizinisch-Bakteriologische Laboratorium. Lothar Hallmann. Georg Thieme Verlag, Stuttgart, Germany, 1953. 252 pp. Illus. DM 19.80.

Intertidal Invertebrates of the Central California Coast. S. F. Light's *Laboratory and Field Text in Invertebrate Zoology,* rev. by Ralph I. Smith *et al.* Univ. of California Press, Berkeley, 1954. 446 pp. Illus. $5.

Foams: Theory and Industrial Applications. J. J. Bikerman. Reinhold, New York, 1953. 347 pp. Illus. $10.

Narcotics and Narcotic Addiction. David W. Maurer and Victor H. Vogel. Thomas, Springfield, Ill., 1954. 303 pp. Illus. $7.50.

Microwave Spectroscopy. M. W. P. Strandberg. Methuen, London; Wiley, New York, 1954. 140 pp. Illus. $2.50.

Cults and Creeds in Graeco-Roman Egypt. The Forwood Lectures for 1952. H. Idris Bell. Philosophical Library, New York, 1953. 117 pp. $4.75.

Elements of Heat Treatment. George M. Enos and William E. Fontaine. Wiley, New York; Chapman & Hall, London, 1953. 286 pp. Illus. $5.

Organic Coating Technology. Vol. I. Oils, resins, varnishes, and polymers. Henry Fleming Payne. Wiley, New York; Chapman & Hall, London, 1954. 674 pp. Illus. $10.

Elementary Quantitative Analysis. Ralph L. Van Peursem and Homer C. Imes. McGraw-Hill, New York, 1953. 383 pp. Illus. $4.50.

Who's Who in Commerce and Industry. A. N. Marquis. Chicago, 1953. 1389 pp.

Electrodeposition Research. Proceedings of the National Bureau of Standards Semicentennial Symposium on Electrodeposition Research held at the NBS on December 4–6, 1951. Natl. Bur. of Standards Cir. 529, 1953. Supt. of Documents, GPO, Washington 25, D.C. 129 pp. Illus. $1.50.

Scintillation Counters. J. B. Birks. McGraw-Hill, New York; Pergamon Press, London, 1953. 148 pp. Illus. + plates. $4.50.

Contributions to the Theory of Riemann Surfaces. Centennial Celebration of Riemann's Dissertation. L. Ahlfors *et al.*, Eds. Princeton Univ. Press, Princeton, 1953. 264 pp. $4.

Information Theory. Stanford Goldman. Prentice-Hall, New York, 1953. 385 pp. Illus. $9.

Communication Theory. Papers read at a symposium on Application of Communication Theory held at the Institution of Electrical Engineers, London, September 22–26, 1952. Willis Jackson, Ed. Academic Press, New York; Butterworths, London, 1953. 532 pp. Illus. $11.

The Theory of Wholes in Chemistry and Its Bearing on the Nature of Biological Catalysts. An essay in theoretical chemistry. J. Vine. Newman Wolsey, London, 1953. 97 pp. Illus. $3.

Annual Review of Physical Chemistry. Vol. IV. G. K. Rollefson and R. E. Powell, Eds. Annual Reviews, Stanford, Calif., 1953. 493 pp. $6.

Principles of Automatic Controls. Floyd E. Nixon. Prentice-Hall, New York, 1953. 409 pp. Illus. $9.35.

Notes on the Quantum Theory of Angular Momentum. Eugene Feenburg and George Edward Pake. Addison–Wesley, Cambridge, Mass, 1953. 56 pp. $2.

Hypnotism. An objective study in suggestibility. André M. Weitzenhoffer. Wiley, New York; Chapman & Hall, London, 1953. 380 pp. $6.

Elements of Statistics. H. C. Fryer. Wiley, New York; Chapman & Hall, London, 1954. viii + 262 pp. Illus. $4.75.

Psychosomatic Case Book. Roy R. Grinker and Fred P. Robbins. Blakiston, New York, 1954. xiii + 346 pp. $6.50.

Sex-Determination. ed. 3. F. A. E. Crew. Methuen, London; Wiley, New York, 1954. vii + 68 pp. $1.50.

Symbolic Wounds. Puberty rites and the envious male. Bruno Bettelheim. Free Press, Glencoe, Ill., 1954. 286 pp. $4.75.

The Challenge of Man's Future. An inquiry concerning the condition of man during the years that lie ahead. Harrison Brown. Viking Press, New York, 1954. xii + 290 pp. Illus. $3.75.

Tissue Culture. ed. 2. The growth and differentiation of normal tissues in artificial media. E. N. Willmer. Methuen, London; Wiley, New York; 1954. xx + 175 pp. Illus. + plates. $2.25.

Manual of the Plants of Colorado. For the identification of the ferns and flowering plants of the state. H. D. Harrington. Sage Books, Denver, 1954. x + 666 pp. $8.

Introductory College Mathematics. Adele Leonhardy. Wiley, New York; Chapman & Hall, London, 1954. 459 pp. Illus. $4.90.

Vegetable Fats and Oils. E. W. Eckey. ACS Monograph Ser. Reinhold, New York, 1954. ix + 836 pp. Illus. $16.50.

Manual of Child Psychology. ed. 2. Leonard Carmichael, Ed. Wiley, New York; Chapman & Hall, London, 1954. ix + 1295 pp. Illus. $12.

Amebiasis. Ernest Carroll Faust. Charles C. Thomas, Springfield, Ill., 1954. xi + 154 pp. Illus. $4.75.

Calculations of Analytical Chemistry. ed. 5. Leicester F. Hamilton and Stephen G. Simpson. McGraw-Hill, New York–London, 1954. xii + 340 pp. Illus. $5.

Tables of Lagrangian Coefficients for Sexagesimal Interpolation. NBS Applied Mathematics Ser., No. 35. National Bur. of Standards, Washington, D.C., 1954. (Order from Supt. of Documents, GPO, Washington 25, D.C.). ix + 157 pp. $2.

Urban Behavior. E. Gordon Ericksen. Macmillan, New York, 1954. xiv + 482 pp. Illus. + plates. $4.75.

The Trees and Shrubs of the Southwestern Deserts. ed. 2. Lyman Benson and Robert A. Darrow. Univ. of Arizona Press, Tucson; Univ. of New Mexico Press, Albuquerque, 1954. x + 437 pp. Illus. + plates. $8.50.

Introduction to Nuclear Engineering. Richard Stephenson. McGraw-Hill, New York–London, 1954. xii + 387 pp. Illus. $8.

Australian and New Zealand Botany. John McLuckie and H. S. McKee. Associated General, Sydney, Australia, 1954. xx + 758 pp. Illus. £4 4s.

Differential and Integral Calculus. ed. 5. Clyde E. Love and Earl D. Rainville. Macmillan, New York, 1954. xiv + 526 pp. Illus. $5.75.

The Psychology of the Criminal Act and Punishment. Gregory Zilboorg. Harcourt, Brace, New York, 1954. xi + 141 pp. $3.50.

Physiology in Diseases of the Heart and Lungs. Rev. ed. M. D. Altschule. Harvard Univ. Press, Cambridge, 1954. xv + 554 pp. $7.50.

Science, Medicine and History. Essays on the evolution of scientific thought and medical practice written in honour of Charles Singer. E. Ashworth Underwood, Ed. Oxford Univ. Press, London–New York, 1953. Vol. I, xxxii + 563 pp.; Vol. II, viii + 646 pp. Illus. + plates. $45 the set.

Matthews' Textile Fibers. Their physical, microscopic, and chemical properties. ed. 6. Herbert R. Mauersberger, Ed. Wiley, New York; Chapman & Hall, London, 1954. x + 1283 pp. Illus. $16.50.

The Behavior and Social Life of Honeybees. C. R. Ribbands. Bee Res. Assoc., London; Hale, Hapeville, Ga., 1953. 352 pp. Illus. + plates. $4.50.

Optical Workshop Principles. Eng. ed. 2. Trans. of *Le Travail des Verres d'Optique de Précision.* Charles Dévé. Trans. by Thomas L. Tippell. Hilger & Watts, London, 1954. xxiv + 436 pp. Illus. + plates. 4s.

Miscellaneous Publications

Who Says the Hydrogen Bomb Is a Mystery? J. Bronowski. Alumni Pub., New York 16, 1953. 23 pp. Illus. 15¢.

A Correlation of Sewage Chlorine Demand Data. Bull. No. 87. Linvil G. Rich *et al.* 12 pp. Illus. 25¢. ***Virginia Mineral Localities.*** Bull. No. 88. Richard V. Dietrich. 55 pp. 50¢. ***Tallol Investigations.*** Bull. No. 89. Frank C. Vilbrandt *et al.* 14 pp. 25¢. Engineering Experiment Station, Virginia Polytechnic Institute, Blacksburg, 1953.

Guide to National Bibliographical Centers, UNESCO Bulletin for Libraries. (In English and French). UNESCO, Paris, 1953. 68 pp. 50¢ (Order from Columbia Univ. Press, New York 27).

List of Cultures of Fungi. Instituto Oswaldo Cruz, Laboratorio de Micologia, Rio de Janeiro, Brazil, 1953. 29 pp.

Halogeton Problem in Utah. Bull. 364. C. Wayne Cook and L. A. Stoddart. Agricultural Experiment Station, Utah State Agricultural College, Logan, 1953. 44 pp. Illus.

Conduction Thermique dans les Gaz Raréfiés Coefficient d'Accommodation. Mémorial des Sciences Physiques, Fasc. LVI. F. Marcel Devienne. Gauthier-Villars, Paris, 1953. 75 pp.

A Revision of the Genus Teriomima *Kirby (Lepidoptera: Lycaenidae).* vol. 3, No. 3. H. Stempffer and N. H. Bennett. 27 pp. + plates. 7s 6d. ***Notes on British Ichneumoninae with Descriptions of New Species (Hym., Ichneumonidae).*** vol. 3, No. 4. J. F. Perkins. 73 pp. Illus. 15s. ***On a Very Remarkable Flea from Argentina,*** by H. E. Karl Jordan, and ***Descriptions of New and Little-Known Siphonaptera,*** by F. G. A. M. Smit. vol. 3, No. 5, 42 pp. Illus. 10s. British Museum (Natural History), London, 1953.

Defense against Recession: Policy for Greater Economic Stability. Committee for Economic Development, New York 22, 1954. 53 pp. Gratis.

Fifth Annual Report for the Year Ending 30 June 1953. Commonwealth (of Australia) Scientific and Industrial Research Organization, Melbourne, 1953. 325 pp.

Preliminary Report on the Froth Flotation of Wake County Talc. Bull. No. 7. R. D. Dillender, Jr., and I. W. Gower. Dept. of Engineering Research, North Carolina State College, Raleigh, 1953. 16 pp. Illus. 35¢.

Effect of Edge Insulation upon Temperature and Condensation on Concrete-Slab Floors. Building Materials and Structures Rpt. 138. Harold R. Martin *et al.* 21 pp. Illus. 20¢. ***Studies of Stone-Setting Mortars.*** Rpt. 139. Daniel W. Kessler and Ross E. Anderson. 23 pp. Illus. 20¢. National Bureau of Standards, 1953. (Order from Supt. of Documents, GPO, Washington 25).

Fluid Gasification of Oil. Research Bull. 16. J. M. Reid *et al.* Institute of Gas Technology Chicago 16, 1953. 48 pp. Illus. $5.

Particules Fondamentales et Noyaux. Paris conference, 24–29 April 1950. Centre National de la Recherche Scientifique, Paris-V, 1953. 229 pp. Illus. 1.800 frs.

The Literature of Geology. Brian Mason. The author, American Museum of Natural History, New York 24, 1953. 155 pp. $2.

Second Annual Report, 1952/53. Joint Establishment for Nuclear Energy Research, Kjeller pr. Lillestrom, Norway, 1953. 41 pp. Illus.

BCSO Review of Science in U.S.A. for the Year Ending June 1952. Her Majesty's Stationery Office, London, 1953. 40 pp. Illus. 2s 6d.

A Hyperbolic Protractor for Microwave Impedance Measurements and Other Purposes. G. A. Deschamps. Federal Telecommunication Laboratories, 1953. 44 pp Illus. $2.50 with protractor. (Order from International Telephone and Telegraph Corp., New York 4).

Relationships of Old and New World Melanians. Proceedings, vol. 103, No. 3325. J. P. E. Morrison. 37 pp. + plate. ***Review of the Labrid Fish Genus*** Wetmorella ***with Descriptions of New Forms from the Tropical Indo-Pacific.*** No. 3327 Leonard P. Schultz and N. B. Marshall. 8 pp. Illus. + plate. ***Review of the Atlantic Periwinkles,*** Nodilittorina, Echininus, ***and*** Tectarius No. 3328. R. Tucker Abbott. 15 pp. Illus. Smithsonian Institution, Washington 25, 1954.

Das Analzäpfchen in der Geschichte der Therapie. P. Diepgen. Georg Thieme Verlag, Stuttgart, 1953. 44 pp. Illus. (Order from Grune & Stratton, New York).

Proceedings and Papers of the 21st Annual Conference, Feb. 1953. Harold Farnsworth Gray and G. Edwin Washburn, Eds. California Mosquito Control Assoc., Turlock. 77 pp. Illus.

Karlgren's Glottal Stop Initial in Ancient Chinese, with Particular Reference to the hPHAGS-PA Alphabet and to Certain Points of Linguistic Psychology. E. R. Hope. The author, 305 Wilbrod St., Ottawa 2, Ontario, Canada, 1953. 89 pp.

Survey of the Bamboos, Industrial Raw Materials of Plant Origin, V. Bull. No. 18. H. H. Sineath *et al.* Georgia Institute of Technology, Atlanta, 1953. 230 pp. Illus. Gratis.

Pedology of Part of the Upper Hunter Valley, New South Wales. Soil Pub. No. 2. R. Brewer and B. E. Butler. 104 pp. Illus. ***Soils of Part of the Southern Flinders Ranges, South Australia.*** Soil Pub. No. 3. G. Blackburn and R. M. Baker. 56 pp. Illus. + plates. Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia, 1953.

National Advisory Committe on Research in the Geological Sciences, Third Annual Report 1952–53. Geological Survey of Canada, Ottawa, 1953. 123 pp.

Contributions to the Anthropology of the Caucasus. vol. 48, No. 1. Henry Field. Peabody Museum of Archaeology and Ethnology, Harvard Univ., Cambridge, Mass., 1953. 154 pp. Illus. $6.50.

Review of Physiological Chemistry. ed. 4. Harold A. Harper. Lange Medical Pubs., Los Altos, California, 1953. 328 pp. Illus.

Guide to Transistor Literature. Glenn L. Martin Co., Baltimore 3, Md., 1954. 54 pp. Free.

Geology of Chaco Canyon, New Mexico, in Relation to the Life and Remains of the Prehistoric Peoples of Pueblo Bonito. Smithsonian Misc. Coll., vol. 122, No. 7. Kirk Bryan. Smithsonian Institution, Washington 25, 1954. 65 pp. + plates.

Professor Meghnad Saha, His Life, Work, and Philosophy. S. N. Sen, Ed. Meghnad Saha 60th Birthday Committee, Calcutta, India, 1954. 175 pp. Illus. $1.50.

General Catalogue of Stellar Radial Velocities. Papers of Mt. Wilson Observatory, vol. 8. Ralph Elmer Wilson. Carnegie Institution of Washington, D.C., 1953. 344 pp. $2.50.

Treponematoses: A World Problem. vol. 8, No. 2–3. World Health Organization, Geneva, 1954 (Order from Columbia Univ. Press, New York 27). 76 pp. Illus. 50¢.

Role of Educational Institutions in Military Research. Occasional Papers No. 3. Robert E. Cron, Jr. Carnegie Institute of Technology, Pittsburgh, 1953. 22 pp. $1.

Technical Papers

Lack of Bactericidal Effect of Mouse Serum on a Number of Common Microorganisms*

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Study of the bactericidal effect of the blood serum of the adult white mouse (albino *Mus musculus*) was undertaken as part of an investigation of the relative role of antibiotics and of nonspecific defense mechanisms in resistance to experimental infection. Various substances and procedures (such as x-irradiation and adrenalectomy) were to be tested for their effect on the bacterial power of mouse serum acting against suitably susceptible bacteria. The method was standardized using rabbit serum because of the relative difficulty of obtaining mouse serum.

In the method used, 0.25 ml of a saline dilution of an 18-hr nutrient broth hour culture of *Bacillus subtilis* (ATCC PCI 220) was added to a tube containing 2.0 ml of a saline dilution of fresh rabbit serum. The mixture was incubated at 37°C. The effects of varying the size of the inoculum, the dilution of serum, and the time of incubation were studied. It was found that when the inoculum was about 2000 organisms (as determined by plate count), rabbit serum diluted 1:10 would render nonviable about 99 percent of the bacteria in 2 hr.

Since this method showed rapid killing of *B. subtilis* by rabbit serum, this organism and also a strain of *Escherichia coli* were tested using mouse serum which was obtained from the pooled blood of eight mice. No evidence of bactericidal action of the fresh mouse serum during 1- or 2-hr incubation was noted with either organism with a 1:3 and 1:10 dilution of serum and inocula of 2000 and 10,000 organisms. A number of other organisms were tested on three different days against fresh pooled mouse serum (four to eight mice) diluted 1:3, inocula of the order of 10,000 bacteria and an incubation time of 2 hr.

The organisms used in these experiments, with the exception of *B. subtilis*, were obtained from the stock culture collection of the Department of Bacteriology, University of Utah. The test organisms were *B. subtilis, E. coli, Pseudomonas aeruginosa, Ps. fluorescens, Proteus vulgaris, Aerobacter aerogenes, Alkaligenes fecalis, Vibrio comma,* and *Salmonella ballerup.*

With none of the aforementioned organisms was there evidence of killing by mouse serum under the experimental conditions described. Indeed, the bacteria were not even inhibited, since in every instance the final bacterial concentration exceeded the initial concentration. Sterility controls showed the serum itself to be free of bacteria in every case.

In addition to the experiments cited, 13 additional experiments have been carried out with serum pools from three or four mice (five experiments with albino *Mus musculus*, six with CBA strain mice, and two with wild *Mus musculus* captured at the Salt Lake City Zoo). The test organism in these later experiments was *B. subtilis.*

The mouse has received very little attention with respect to this type of study. Zinsser, Enders, and Fothergill (*1*) have reviewed numerous studies on the bactericidal action of serum from a variety of common laboratory and domestic animals with the exception of the mouse. Since the organisms employed in the present experiments were species ordinarily susceptible to the bactericidal action of serum from other animals (*2*), the results suggest that mice occupy a unique position among mammals in having serum devoid of bactericidal power against these organisms.

References

1. H. Zinsser, J. F. Enders, and L. D. Fothergill, *Immunity: Principles and Applications in Medicine and Public Health* (Macmillan, New York, 1940) p. 194.
2. F. P. Gay *et al., Agents of Disease and Host Resistance* (C. C. Thomas, Springfield, Ill., 1935) p. 310.

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Plant Tissue Cultures Produced from Single Isolated Cells*

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The value of plant materials for fundamental studies of growth was increased by the successful cultivation of plant tissues *in vitro* (*1–4*). Although this development was an important advance, the desirability of producing such cultures from single isolated cells has long been recognized (*5*). Plant tissue cultures display a degree of physiological and morphological variability that may be troublesome in analytical investigations. Although the tissue of a culture is derived from one plant, the potentialities of the cells may differ. This seems especially true of cultures derived from pathological growths, such as crown

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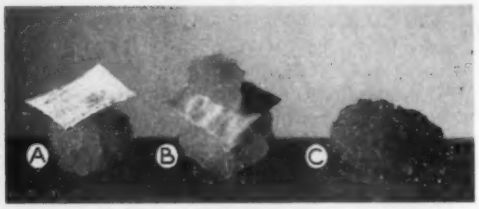

Fig. 1. *A*, filter paper, 8 × 8 mm, over sunflower culture. *B*, marigold culture of single-cell origin growing on filter paper over sunflower. *C*, marigold culture of single-cell origin, growing independently.

gall, where chromosome numbers vary (*6*) and normal and abnormal cells of several types may exist together. Cultures derived directly from single isolated cells might show less variation and prevent confusion from mixtures of cell types.

Cultures of animal tissue recently have been grown from single isolated cells (*7*). The present report describes the production of tissue cultures from single isolated cells of higher plants.

Single cells were obtained from tissue cultures of marigold (*Tagetes erecta* var. Sunset Giant) of crown gall origin (*8*) and of tobacco (*Nicotiana tabacum* var. Havana 38) from the normal stem. These tissues had been maintained in culture for several years (*9*). Their friable growth on agar media suggested that single cells might be obtained more readily than from firm cultures.

An abundant, diffuse type of growth consisting of single cells and small clumps of cells resulted when the marigold and tobacco tissues were grown in liquid culture on a reciprocal shaker (*10*). Suspensions of cells were easily removed and spread over an agar medium. It was more difficult to obtain single cells from tissue grown on agar.

Single cells, deposited on an agar medium, were located under a dissecting microscope and removed with a flattened needle under aseptic conditions. They were placed on 8 by 8 mm squares of sterile filter paper (Reeve Angel, crepe surface, No. 202). These squares had been resting for two or more days on the top surface of young tissue cultures (about 7 mm in diameter) of marigold, sunflower, or tobacco growing on an agar medium. Each filter paper square was then returned to the upper surface of the "host" culture from whence it came (Fig. 1). These operations required speed to avoid injury from excessive light and desiccation. At no time was the upper surface of the filter paper in direct contact with the underlying host tissue. Double layers of paper were used in numerous trials, including some that were successful. More than 1500 cells were isolated. Marigold and sunflower cultures were "hosts" for single marigold cells, because both grow well on the same synthetic medium (*9*). Tobacco cultures were "hosts" for single tobacco cells.

After precision was achieved, about 8 percent of the marigold and tobacco cells isolated grew and divided. Marigold cells grew on filter paper over either marigold or sunflower tissue. It was necessary to transfer the filter paper to a fresh host piece one or more times; for as a host culture became old and senescent, the young culture it supported also lost vigor. After reaching a diameter of 4 mm, which usually required 6 to 10 wk, cultures resulting from single cells were transferred directly to agar medium, where they grew well independently (Fig. 1). Several stocks of single-cell origin have been carried through four or more agar transfers, each of approximately 5 wk. The tissues were subdivided to a diameter of 4 mm each time, and no diminution in growth rate occurred.

The usefulness of plant tissue cultures of single-cell origin is apparent, for example, in studies on biochemical, morphologic, and genetic differences between normal and gall tissues (*11–13*), on virus-free and virus-infected tissues (*14*), on the habituation process for plant growth regulators, and on mutation to diseased or to healthy tissue. The single cell eliminates the possibility of culture change due to variation in the proportions of the cell types present in an original mixture.

References

1. R. J. Gautheret, *Compt. rend. acad. sci.* (Paris) **208**, 118 (1939).
2. P. Nobecourt, *Compt. rend. soc. biol.* (Paris) **130**, 1270 (1939).
3. A. J. Riker and A. C. Hildebrandt, in *Growth and Differentiation in Plants*, W. E. Loomis, Ed. (Iowa State College Press, Ames, 1953), p. 393.
4. P. R. White, *Am. J. Botany* **26**, 59 (1939).
5. G. Haberlandt, *Sitzber. Akad. Wiss. Wien, Math.-naturw. Kl.* **3**, 69 (1902).
6. M. Levine, *Am. J. Cancer* **15**, 1410 (1931).
7. K. K. Sanford, W. R. Earle, and G. D. Likely, *J. Natl. Cancer Inst.* **9**, 229 (1948).
8. A. C. Hildebrandt and A. J. Riker, *Am. J. Botany* **36**, 74 (1949).
9. ———, ———, and B. M. Duggar, *Am. J. Botany* **33**, 591 (1946).
10. W. H. Muir and A. C. Hildebrandt, mimeographed abstract Am. Soc. Plant Physiol. (Am. Inst. Biol. Sci. Madison, Wis. 1953).
11. A. C. Braun, *Science* **113**, 651 (1951).
12. G. Camus, *Rev. cytol. biol. végétales* **11**, 1 (1949).
13. R. S. De Ropp, *Am. J. Botany* **35**, 372 (1948).
14. A. C. Hildebrandt, A. J. Riker, and J. L. Watertor, *Phytopathology* **43**, 475 (1953), abstract.

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Till-like Deposits on Natapoc Mountain

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About 11 mi north of the town of Leavenworth, in north-central Washington near the center of the Chiwaukum quadrangle, is Natapoc Mountain (Fig. 1), an outstanding topographic feature that has been carved from Eocene sandstones (*1*). The summit of the mountain is 2 mi west of the Wenatchee River and is 4235 ft in elevation, rising 2530 ft above the river. The mountain lies within the Wenatchee River drainage area and is entirely surrounded by deep well-defined valleys. On the west is the crest of the Cascade Mountains and on the east are the Entiat Mountains, marginal ridges composed of granitic and metamor-

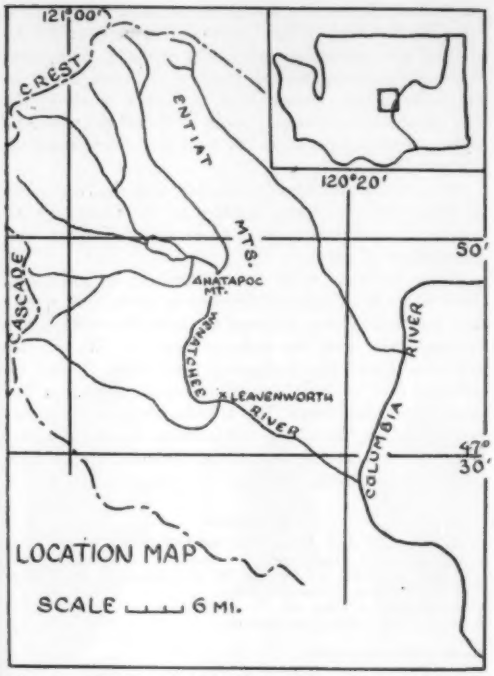

Fig. 1. The Cascade Mountains of north-central Washington. Inset shows position of this area in the state of Washington.

phic rocks and rising from 2000 to 3500 ft above the summit of Natapoc Mountain.

On top of Natapoc Mountain during a hasty reconnaissance, Parrott and Hougland reported finding a layer of till about 100 ft thick consisting of boulders and pebbles of basalt, granite, schist, peridotite, and quartz cemented in a matrix of clay and silt (*2*). They stated that glacial erratics and till are distributed rather promiscuously on upper ridges of the mountain. No other evidence was presented that would definitely indicate a glacial origin for the deposits.

A reconnaissance of the mountain that I made in Sept. 1948 suggested a similar origin for the deposits, but in June 1951, I conducted a field study of these deposits.

Three tenable conclusions regarding the origin of the till-like deposits present themselves. First, if glacial in origin, they could be deposits related to the recognized glaciations in the area. Second, if not identified with any known glaciations, they could belong to an older, hitherto unknown, and more extensive glaciation. Third, if not glacial, or transported, they could be residual, or derived from the disintegration of the underlying bedrock.

Ben M. Page, working in the lower Wenatchee Valley near Leavenworth, identified three alpine glaciations (*3*). Beginning with the earliest, he designated them as Peshastin, Leavenworth, and Stuart. Stuart till is fresh, young, confined to moderate and high altitudes, and retains much morainic topography. Leavenworth till is more extensive, retaining considerable morainic topography, and with contained granite stones showing thin weathering rinds. Peshastin till is still more extensive, with some morainic topography, and with granite stones largely decomposed.

In the vicinity of Natapoc Mountain in the upper Wenatchee Valley, I identified two tills and tentatively correlated them with Page's Leavenworth and Stuart tills. This correlation is made on the basis of weathering on granite stones, areal extent, and field relationships of the till (*4*).

The till-like deposits, if identifiable with these known tills, would almost certainly contain about the same percentages of rock types as do the recognized tills. Granite rocks, which are common in the tills, are rare in the till-like deposits, whereas andesite rocks, which are most uncommon in the tills, comprise at least 90 percent of the till-like deposits.

If the till-like deposits are glacial in origin, then one would expect to find other deposits containing rocks that are closely similar in grain size, and types and percentage of rock elsewhere within the Wenatchee River drainage area. It is significant to note, however, that no similar deposits are known to occur elsewhere within the area.

Terminal glacial deposits of Page's Leavenworth and Stuart stages lie within a vertical range of 700 ft, and the corresponding upper Wenatchee Valley tills are separated by about 200 ft of elevation. No more than 750 vertical feet lie between the Peshastin and the Stuart terminal tills. When a similar comparison of relative elevations is made between the younger upper Wenatchee Valley till and the till-like deposits, a very obvious discrepancy arises. Fully 2500 ft of elevation separates the till-like deposits and this younger till. Surely, this extreme difference in elevation eliminates the possibility of identifying the till-like deposits with the recognzed tills in the area.

Also, the very limited extent of the till-like deposits (confined to the upper slopes of Natapoc Mountain) is insufficient evidence to definitely identify them with a glaciation older than the Peshastin.

The till-like deposits, then, are not glacier transported but, instead, are residual. This interpretation is strengthened by the fact that flat-lying volcanic sediments which cap the mountain are similar, both lithologically and in grain size, to the till-like deposits.

Unconformably overlying the tilted Eocene sandstones from which Natapoc Mountain has been eroded are flat-lying sediments composed of agglomerates and coarse sandstones that are clearly of volcanic origin. The agglomerates consist of subangular and rounded pebbles and boulders of schist, peridotite, quartz, granite, and scoriaceous andesite cemented in a matrix of finer volcanic material. The andesite comprises at least 90 percent of the whole. About 20 to 30 ft of these volcanics are exposed in a cliff on the south side of the mountain, with rock fragments ranging in size from small pebbles to boulders 4 ft in diameter. The

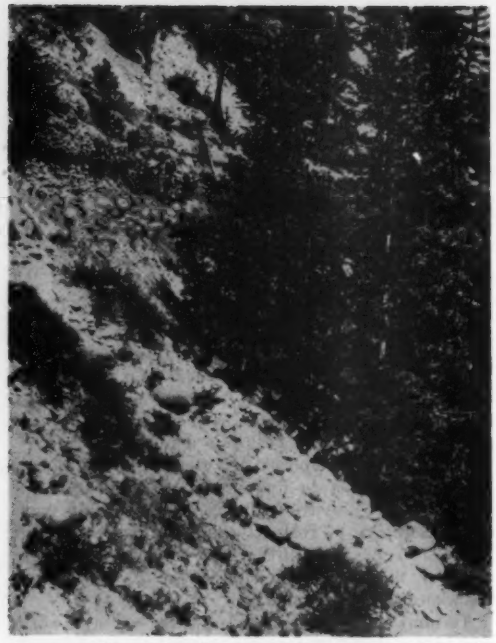

Fig. 2. View near the summit of Natapoc Mountain showing the 20 to 30 ft of flat-lying volcanic sediments capping the mountain. Note large boulders, which are mostly of andesite, protruding from the sediments. The bouldery debris at the base of the cliff has weathered from the loosely cemented beds. This debris is confined to the upper slopes of the mountain, except where it has been washed into and down canyons, and comprises the till-like deposits.

boulders are loosely cemented in the volcanic beds. Capping the volcanics are the 100 ft of deposits that Parrott and Hougland identified as till (Fig. 2).

Within the till-like deposits and on the summit of the mountain are many large boulders of andesite, and at first glance a casual observer would certainly assume them to be erratics of glacial origin. At several places along the summit ridge, however, the bedrock, which consists of large andesite boulders cemented in a dark gray matrix of finer volcanic material, is exposed. Except for limited exposures, the loose bouldery debris almost completely hides the summit bedrock from view.

The fact that bedrock is found at the summit of the mountain indicates that the till-like deposits do not form a thick layer as heretofore suspected but, instead, are actually a thin veneer of debris derived from the disintegration of the underlying volcanic beds. The volcanic beds, therefore, must be 100 to 150 ft thick, extending upward from the unconformity to the summit of the mountain.

Deep gulleys and ravines have scored the slopes of the mountain, exposing accumulations of water-worn pebbles and boulders which are mostly of andesite. In general, the rock types on the surface of the ground have moderately rough surfaces, usually reddish-stained, but exposures reveal only moderate oxidation, the material being almost identical in appearance to the rocks in the volcanic beds. No facets or striations of probable glacial origin could be found anywhere in these accumulations or in the bouldery debris capping the mountain.

In addition, the till-like deposits contain fragments of rock that are closely similar to the fragments of rock in the volcanic beds in grain size and types and percentage of rock.

If the andesite rocks can be used as an indicator, there is no discernible difference in grain size, quantity, and weathering between the andesite rocks in the volcanic beds and the andesite rocks in the till-like deposits. From the foregoing discussion, it can be inferred that a glacial, or transported, origin for the deposits is improbable. The till-like deposits on Natapoc Mountain, therefore, are residual, having resulted from the weathering and disintegration of the flat-lying volcanic beds capping the mountain.

References

1. E. Hougland, *Pan Amer. Geol.* **58**, 263 (1932).
2. G. Parrott, *A Study of the Fresh-Water Sediments North of Leavenworth, Washington*, B. Sci. thesis, State College of Washington, Pullman (1932).
3. B. M. Page, *J. Geol.* **47**, 785 (1939).
4. W. A. Long (1951) unpublished.

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Distribution of Y^{90} in Ascites Tumor Mice Following Intraperitoneal Administration of Yttrium Chloride*

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It has been previously reported from this laboratory that lanthanum chloride containing La^{140}, when injected *intraperitoneally* into normal and ascites tumor-bearing mice, is localized mainly in the peritoneal cavity (*1*). Autoradiograms demonstrated the deposition of La^{140} on the surface of the liver and of other intra-abdominal organs. Furthermore, inhibition of growth of ascites tumor following the intraperitoneal administration of $La^{140}Cl_3$-containing carrier was demonstrated (*2*).

The favorable radiation characteristics of the yttrium isotope Y^{90}, a pure β-emitter of 2.2 Mev with a 60-hr half-life, as well as the similarity of chemical behavior of yttrium to lanthanum and other rare-earth elements, suggested the study of Y^{90} under conditions similar to those carried out with lanthanum. The choice of yttrium for intracavitary application

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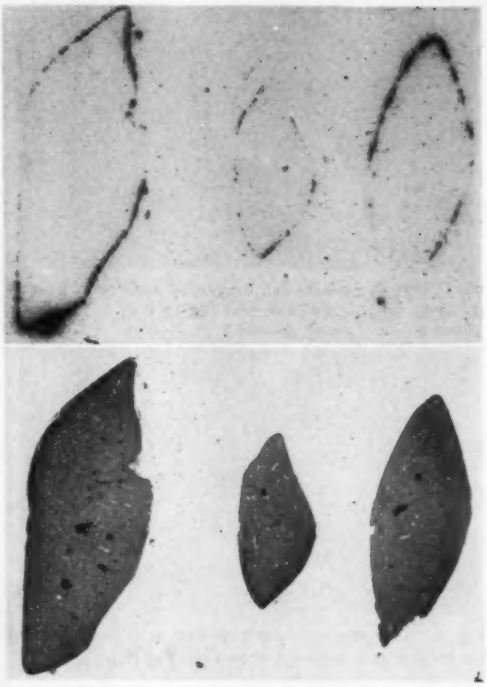

Fig. 1. Photomicrograph of sections and autoradiograms of liver of a mouse bearing ascites tumor following the intraperitoneal injection of 1.5 mg yttrium chloride containing 50 μc Y^{90}. The animal was sacrified 4 days after the injection.

was further indicated by virtue of its poor absorption after intraperitoneal injection (*3*).

Representative data on tissue distribution of intraperitoneally injected YCl_3 (*4*) are presented in Table 1. This table also demonstrates the influence of the carrier content on the distribution of Y^{90}. When the carrier content was 0.08 mg Y^{+++}, 1.4 percent of the

Table 1. Distribution of yttrium following intraperitoneal injection of YCl_3 into Ehrlich ascites tumor mice. Activity: 50 μc Y^{90}. Y^{+++} in group A, 0.08 mg; in group B, 4.0 mg. The animals were inoculated with 0.1 ml ascites fluid. The yttrium chloride was injected 3 days later. The animals were sacrificed 4 days after the injection of Y^{90}.

Tissue	Percentage of injected dose per organ		Microcuries of Y^{90} per organ		Micrograms of Y per organ	
	A	B	A	B	A	B
Heart	0.082	0.014	0.04	0.007	0.066	0.56
Lung	.59	.053	.29	.027	.47	2.1
Muscle*	1.3	.091	.65	.046	1.04	3.6
Bone†	1.4	.018	.7	.009	1.1	0.72

* Muscle calculated as 45 percent of body weight.
† Bone calculated as 6 percent of body weight.

administered Y^{90} was found in the skeleton 4 days after the injection. The skeletal uptake of Y^{90} was even less (0.02 percent of the administered Y^{90}) when the amount of yttrium carrier was 4.0 mg Y^{+++}. Autoradiograms of liver sections from animals injected with 1.5 mg of carrier yttrium show deposition of the radioisotope on the capsular surface of the liver only (Fig. 1), whereas diffuse uptake of Y^{90} by the liver is observed following the intraperitoneal injection of Y^{90} with a carrier content of 0.08 mg Y^{+++}. Thus, the autoradiograms further illustrate the influence of the added carrier upon the localization of intraperitoneally injected *ionized* Y^{90}.

Distribution studies employing Y^{90} were also carried out in terminal cancer patients with pleural or peritoneal effusions. In the presence of added carrier, preferential localization of this isotope in the injected cavity has been demonstrated similar to that observed in ascites tumor mice. These data, as well as experiments on the localization of Y^{90}, when injected in unionized form, have been presented elsewhere (*5*).

References and Notes

1. D. Laszlo *et al., J. Natl. Cancer Inst.* **13**, 559 (1952).
2. R. Lewin *et al., J. Natl. Cancer Inst.* **14**, 45 (1953).
3. W. Bloom, *Histopathology of Irradiation from External and Internal Sources.* (McGraw-Hill, New York, 1948), p. 267.
4. Irradiated units containing approximately 125 mc Y^{90} and 250 mg Y_2O_3 were obtained from the Brookhaven National Laboratory. All samples were counted with an end-window counter having a sensitivity of 160,000 cpm/μc.
5. R. Lewin *et al.*, annual meeting, Am. Assoc. for Cancer Research, Apr. 1954.

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Succinic Dehydrogenase Inhibition in Gall-Bladder Epithelium and in Liver Cells of Pregnant Mouse

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Succinic dehydrogenase activity of gall-bladder epithelium has escaped any notice in previously published studies regarding the histochemical distribution of this essential enzyme of Krebs cycle in animals (*1–4*). Employing neotetrazolium as a histochemical indicator, I have demonstrated a fairly intense activity of succinic dehydrogenase in the gall-bladder epithelium of mouse, guinea pig, and man. The present investigation shows that succinic dehydrogenase activity is depressed in the gall-bladder epithelium and in the liver cells of the pregnant mouse.

Fifteen pregnant albino mice whose fetuses weighed 850 to 1175 mg and 15 nonpregnant littermates of them were used. Ten animals of both groups were killed after a 24-hr fasting period, and five after being fed half an hour before the decapitation. The gall bladder with a surrounding piece of liver from each pregnant animal was sectioned simultaneously with a corresponding control specimen with a freezing micro-

tome at 40 μ. The frozen sections were dipped directly from the cooled knife for 40 min into their respective incubation vials at a constant temperature of 37°C. The incubation mixture was prepared according to Seligman and Rutenburg (*1*), except that neotetrazolium was employed instead of blue tetrazolium.

In the control animals, the cytoplasm of the tall columnar cells of gall-bladder epithelium showed a deposit of fine purple granules of formazan, indicating an intense activity of succinic dehydrogenase. The densest granulation was noticeable in the basal parts of the cells corresponding to their mitochondrial arrangement (Fig. 1).

The gall-bladder epithelium of the fasting pregnant mice constantly showed a depression in the succinic dehydrogenase activity, as compared with the corresponding controls. In the fed pregnant mice, there was a moderate staining in the epithelial cells, but the granulation was sparser than in the controls (Fig. 2). Both in the nonpregnant and in the pregnant animals, the glands of the gall-bladder neck exhibited a considerable activity of succinic dehydrogenase, whereas the smooth muscle was stained only by a pale reddish hue, if at all.

In the pregnant mice, the liver was not so darkly pigmented as in the controls. The liver sections from pregnant animals displayed a monotone reddish purple color instead of the bluish purple staining with clearly demarcated lobules in the control specimens. This was due to a narrower zone of pigmentation in the periportal areas of lobules in pregnant mice and to a sparser deposition of formazan granules in the corresponding cells (Figs. 3, 4).

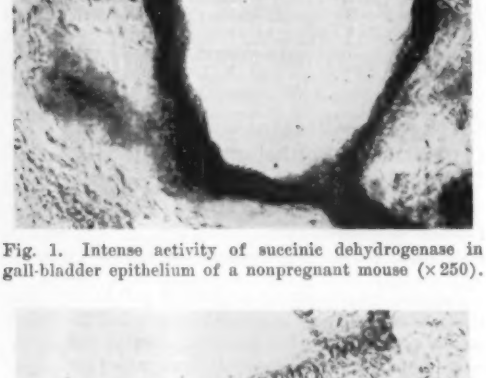

Fig. 1. Intense activity of succinic dehydrogenase in gall-bladder epithelium of a nonpregnant mouse (×250).

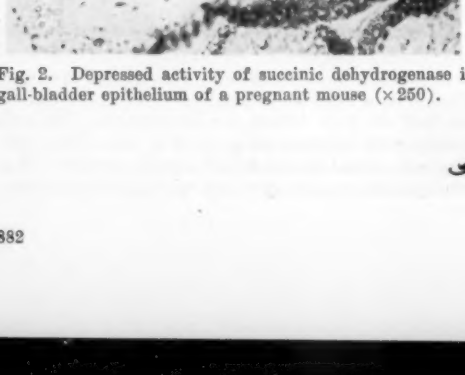

Fig. 2. Depressed activity of succinic dehydrogenase in gall-bladder epithelium of a pregnant mouse (×250).

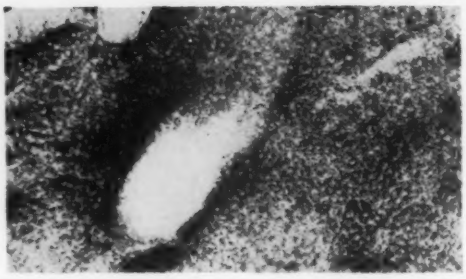

Fig. 3. High succinic dehydrogenase activity in liver of the same nonpregnant mouse as in Fig. 1 (×90).

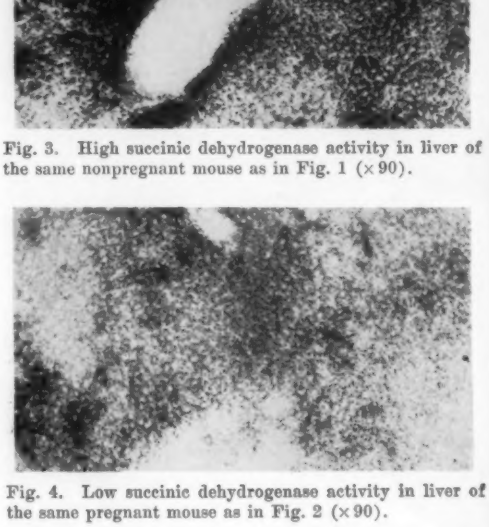

Fig. 4. Low succinic dehydrogenase activity in liver of the same pregnant mouse as in Fig. 2 (×90).

The energy for the selective concentration of bile in gall-bladder epithelium is evidently yielded by the oxidative breakdown of carbohydrates and lipids. In this chain of reactions, inhibition of succinic dehydrogenase may participate in the depression of the inspissating capacity of gall bladder in late pregnancy. The high production of estrogens, known as *in vitro* inhibitors of the succinic dehydrogenase system (*5*), may play a role in the reversible inhibition of this enzyme observed in the liver cells and in the gall-bladder epithelium. Further studies are in progress to substantiate these possibilities.

References

1. A. M. Seligman and A. M. Rutenburg, *Science* **113**, 317 (1951).
2. H. A. Padykula, *Am. J. Anat.* **91**, 107 (1952).
3. A. M. Rutenburg, M. Wolman, and A. M. Seligman, *J. Histochem. and Cytochem.* **1**, 66 (1953).
4. H. A. Malaty and G. H. Bourne, *Nature* **171**, 295 (1953).
5. W. H. McShan, R. K. Meyer, and W. F. Erway, *Arch. Biochem.* **15**, 99 (1947).

Received January 18, 1954.

Communications

A New Clinical Test for Intravascular Clot

The cardiovascular tree normally contains somewhat over 5 lit of blood in the liquid state. Slowing down of the stream, trauma to the vessels, inflammation, disease, obstruction, and so on, upset this balance. Sludging of the formed elements along the side walls occurs, and this progresses to the formation of a clot. The continued presence of one or more of the precipitating factors causes the clot to extend. Clinically, a thrombo-phlebitis is diagnosed when heat, redness, pain, swelling, and so forth are present. In the absence of these signs and symptoms, the diagnosis is obscure. Despite this, a bland clot of phlebo-thrombosis may be dislodged and migrate to the pulmonary arteries with a fatal result. Despite great activity on this medical frontier, and the use of anticoagulant drugs, the death rate from pulmonary embolism remains unchanged. More than half the fatalities occur in patients who were not suspected of having an intravascular clot.

The bulk of these patients may be picked up by the following test which must be made when the patient enters the hospital. A pneumatic cuff is distended over the calf or thigh slowly to 180 mm of Hg pressure. If pain is elicited before this, the end point has been reached and the cuff is deflated. A positive cuff test is indicated by pain beneath the inflated cuff at 80, 100, or 120 mm of Hg. A negative test that becomes positive a few days post-operatively or several days after a patient has been put to bed with a myocardial infarction is presumptive evidence of intravascular clot and should be treated as such. Several hundred patients have been tested in this manner, and at this time the results are gratifying (*1*).

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Reference

1. For complete details, including case reports and a bibliography, see R. I. Lowenberg, *J. Am. Med. Assoc.*, in press.

Received February 2, 1954.

Longevity under Adversity in Conifers

Edmund Schulman's recent contribution [*Science* 119, 396 (1954)] on longevity in conifers presents many facts concerning the occurrence of particularly old conifers but offers little to account for these occurrences or to clarify the connection between high ages an environments. Actually, there appear to be sound reasons why such old specimens occur where they do and why they represent only a limited number out of the total native coniferous species.

Although, in his paper, Schulman deals primarily with trees growing in environments adverse to rapid growth, the oldest living examples, individuals of *Sequoia gigantea*, are found in environments highly favorable for growth, and this is relatively true also for *Sequoia sempervirens* and *Fitzroya cupressoides*. Young trees of *S. gigantea* almost invariably show rapid diameter increment, and only after they gain considerable size does their growth eventually become slow.

There is reason to believe that the favorable nature of the environment contributes to the unusual longevity in these species. Another very important factor in their longevity is the absence of aggressive insect enemies, such as defoliators or primary bark beetles, or serious diseases other than heart rots. A third factor is their capacity for adaptation to temporary changes in moisture supply or to partial loss of crowns without an accompanying danger of early mortality. A fourth factor is the long-sustained vigor of their root systems, for it is the functioning of the roots that primarily determines the age to which a tree will live, barring destruction by external agencies. With regard to heart rots, the evidence (*1*), which there is not space to discuss here, indicates that there is no basis for regarding them as "a form of dieback," as Schulman's interjected question suggests.

For the species for which longevity appears to be associated with adverse situations, some of the important features in the environment of a long-lived tree are (i) comparative isolation; (ii) low annual precipitation and relatively low air humidity; (iii) absence of destructive pests; and (iv) an exposed position, insuring ample air movement. Open surroundings are essential, not only to encourage a stout, spreading form of growth and as a protection from destruction by running fires, but, more important, to provide ample unoccupied ground into which the roots will be able to spread during the life of the tree.

With some species, geographic isolation is also a prime requisite. It is significant that the only ponderosa pine among the old trees in Schulman's list is situated outside the range of the western pine beetle, *Dendroctonus brevicomis*, and also outside the areas where the needle fungus, *Elytroderma deformans*, is destructive. The propensity of the western pine beetle for attacking old, slow-growing, or declining ponderosa pines is so well established that trees of this character are marked for cutting to prevent their loss from beetles (*2*). Many individuals of species such as Engelmann spruce (*Picea engelmanni*) would undoubtedly reach relatively high ages were it not for devastating bark beetle epidemics (*3*, *4*) or activities of other destructive enemies.

Low annual precipitation restricts growth and consequent disadvantageous bulk but still permits the tree to maintain life. Low humidity favors the development of compact foliage and discourages the establishment of disease and decay fungi, an effect further heightened by the rapid air movement associated

with an exposed position. The relative absence of decay in old trees in locations such as the White Mountains rests primarily on these climatic features of the local environment, together with low night and winter temperatures, long distances from spore sources for decay fungi, a high resin content of exposed wood, and the presence in the wood of fungistatic phenolic substances such as pinosylvin (*5*).

A tree may be reproduced vegetatively through numerous generations, and therefore one may deduce that it is capable of indefinite life, yet all field evidence points to the conclusion that any individual tree, as such, ages as does any other complex organism, with death as the final outcome. Foresters recognize this in the formulation of tree classifications (*6*). For most conifers, the end comes through insect attack or other visitation after physiological decline has become marked. For *Sequoia gigantea*, which is unusually free of insect enemies, it hardly seems necessary to suggest, as Schulman has done, the possibility that all then living specimens were wiped out by some catastrophe 3000 to 4000 yr ago. The end for these forest giants comes when reduction in root systems through deterioration reaches a point at which the tremendous bulk of trunk and top can no longer be mechanically supported, and they fall. This accounts for the lack of standing sequoia snags on which Schulman has remarked.

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References

1. W. W. Wagener and R. W. Davidson, *Botan. Rev.* **20**, 61 (1954).
2. K. A. Salman and J. W. Bongberg, *J. Forestry* **40**, 533 (1942).
3. F. P. Keen, *U.S. Dept. Agri. Misc. Publ.* 273 rev., 163 (1952).
4. J. L. Mielke, *J. Forestry* **48**, 882 (1950).
5. E. Rennerfelt, *Statens Skogsforskningsinst. Medd.* **33**, 331 (1943).
6. F. P. Keen, *J. Forestry* **41**, 249 (1943).

Received April 19, 1954.

I am grateful that my report of some precise dating work on newly discovered Methuselahs among stunted conifers has called forth a professionally competent review of possible factors favoring their existence. The rich category of old *little* trees, which, in contrast to the category of old *big* trees, appears to have been quite neglected until recent years, may well owe its existence, as Wagener implies, to a set of factors largely different from those that favor lush growth.

Although the reasons for the occurrence of old drouth conifers summarized by Wagener are surely appropriate, my own field experience strongly suggests that special factors play a major role in the cases of those relatively few examples of absolute maximum longevity, to which my report in *Science* was necessarily limited. It was repeatedly observed that, in a general and usually rugged area of high aridity in which occurred very old trees growing on adverse sites, only one or two small localities bore the individuals of maximum ages, and these ages were often quite markedly greater than those elsewhere in the area. That natural selection has operated at such sites is, perhaps, obvious. Local concentrations of soil antibiotics may well exist. And that the wood may contain special substances, as Wagener notes, is indeed likely; a more satisfactory statement in this regard may perhaps be made when chemical analysis has been completed of the stem of the 1650-yr Sun Valley limber pine (tree No. 3966, Table 1, of my article), which was felled in part for this purpose.

Wagener's preference for the second of the two possibilities suggested by the lack of standing giant sequoia snags seems well based.

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Received May 7, 1954.

The Piltdown Nasal Turbinate and Bone Implement: Some Questions

Now that the Piltdown mandible has been established as that of an anthropoid ape (*1*) and the larger cranial bones shown to have originated from three different sources (*2, 3*), some questions and doubts seem to be in order concerning the remaining Piltdown skull bones and artifacts. When I examined the original Piltdown bones in 1951 (*4*), I was astonished to find that, among the human bones recovered at Piltdown, substantial portions of a turbinate were represented. Dawson (*5*, p. 85) described the discovery of the turbinate as follows:

> While our labourer was digging the disturbed gravel within 2 or 3 feet from the spot where the mandible was found, I saw two human nasal bones lying together with the remains of a turbinated bone beneath them *in situ*. The turbinal, however, was in such bad condition that it fell apart on being touched, and had to be recovered in fragments by the sieve; but it has been pieced together satisfactorily by Mrs. Smith Woodward.

Woodward in the same paper (*5*, p. 87) observed:

> The remains of a turbinal found beneath the nasal bones are too much crushed and too fragmentary for description; but it may be noted that the spongy bone is unusually thick, and has split longitudinally into a series of long and narrow strips.

I have not studied this turbinate, so that I can say nothing useful concerning its anatomical characteristics, but what strikes me as most remarkable about this bone is its very existence. I do not recall any instance in the annals of paleoanthropology of this extremely fragile bone ever having been recovered in a fossil hominid. Indeed, the delicacy of the turbinates is such that these bones are among the first to crumble even in comparatively recent burials. In view of the doubt that at present surrounds the whole Piltdown find, it seems necessary to explain the presence of the turbinate bone.

Is it possible that the turbinate does not in fact

naturally belong with the other skull bones? If it does not, how does it come to be together with the other Piltdown bones? If it does naturally belong with the Piltdown bones, then it may be regarded as casting considerable doubt upon the antiquity of the Piltdown skull, or else as representing a unique example of the preservation of this delicate bone in a fossil hominid. The third alternative is that the turbinate belonged to the chimpanzee owner of the mandible.

Marston has several times drawn attention to the probable significance of the turbinate. In his Swanscombe report, Marston (*6*) pointed out that if the turbinate belonged to the Piltdown skull, then the horizon of Piltdown is to be judged from the turbinate bone. Later, he wrote (*7*, p. 275)

> . . . since the frail turbinate bone and nasal bones belonging to the Piltdown skull had been preserved and recovered, their preservation is incompatible with the period represented by the fauna which includes the broken teeth of Mastodon, Stegodon, Rhinoceros, Hippopotamus, nor with the so-called associated flint implements which are [sic] battered and abraded during the distribution of the Piltdown gravels. The Piltdown remains therefore belong to a later period from the deposits in which they were found.

Referring to Dawson's account of the finding of the turbinate, Marston (*8*, pp. 293–294) writes:

> Now the turbinal bones, because of their frailty, are the first bones of the skull to disintegrate even in protective burials. Mr. Dawson has here stated clearly that it and the nasal bones were found when digging the disturbed gravel. This supports the view that the turbinal and nasal bones fell away from the skull when the skull was broken up by the workmen at least six years before. The pit was a shallow excavation by the roadside not more than five feet in depth. These bones, the turbinal and nasal, fell to the floor of the pit. The great spread at Piltdown has generally been considered to have been deposited by running water, *i.e.*, to have been fluviatile, but solifluxion phenomena cannot be excluded from any of the four strata of which they consist. Solifluxion meaning the flow of semi-solid material in thawing out from frozen conditions. Now it is obvious that if the nasal and turbinal bones had fallen from the skull at the period of the distribution of the gravel spread and had thus become naturally geologically separated from the skull, under fluviatile or river conditions they would have been carried down-stream, and under solifluxion conditions where the semi-frozen sludge is churned up and festooned, these frail bones would have been pulverized out of existence. Hence it would appear probable that the skull to which the nasal and turbinal bones belonged found its way into the Piltdown gravels after and not during the period of distribution of the gravel-spread by fluviatile action.

Marston's argument seems to me unanswerable.

There are several other points. Dawson stated that he "saw two human nasal bones lying together with the remains of a turbinated bone beneath them *in situ*." This is very curious. The nasal bones, unless they are united at the internasal suture, are likely to become separated from each other as soon as they are detached from the skull. If these bones were not so united how does it happen that they were found together? Even more curious is the finding of the turbinate beneath the nasal bones "*in situ*." Neither the ethmoidal nor the inferior turbinates are in any way attached to the nasal bones. They were found in *disturbed gravel*; how then is it possible that these bones came to lie together in the manner described? It is highly improbable that they came to lie together naturally, for reasons such as those already given by Marston. A more likely explanation is that the person who placed the mandible in the pit also put the nasal and turbinate bones together. This reveals some book knowledge of human anatomy but clearly that of a person who has never really studied the skull in detail. The nasal bones might have passed, but the turbinate in itself and in relation to the nasal bones was a mistake.

The "*in situ*" is more than strange, for Dawson distinctly says that the laborer was digging *disturbed* gravel when he, Dawson, saw the nasals and turbinate. How anything can be "*in situ*" in disturbed gravel is a puzzle. Perhaps Dawson meant the "*in situ*" in an anatomical sense to refer to the relation of the turbinates to the nasal bones—in which case he would again have been in error.

Finally, there is the matter of the "bone implement" found at Piltdown. We know that there were no flint implements associated with the Piltdown skull fragments. The "doubtful artifact" that was recovered from the same seam of gravel as the Piltdown bones has been shown by Oakley and Weiner (*9*) to have been a fake. In 1915, Dawson and Woodward reported the discovery of a "bone implement." This was made from part of the femur of a fossil elephant and, according to Dawson and Woodward (*10*, pp. 144, 147), the bone, although found

> about a foot below the surface in dark vegetable soil, beneath the hedge which bounds the gravel-pit, and within 3 or 4 feet of the spoil-heap whence we obtained the right parietal bone of the human skull, . . . originally occurred in the lowest layer of the Piltdown section.

Oakley (*11*) has pointed out that, while there can be no doubt that the terminal facets on this bone are human work,

> On the other hand, they do not bear close comparison with the scratchy cuts made by a flint knife or primitive chopper. It is possible that the bone was picked up in a fossilized condition and hacked with an even-edged chopper or heavy metal knife during late prehistoric or more recent times.

These points had already been made at the Geological Society meeting at which Dawson and Woodward presented their paper. Reginald Smith suggested (*10*, p. 148) that

> The possibility of the bone having been found and whittled in recent times must be considered; and, if it were not shaped in its fossil state, it had evidently never been used for any purpose such as grubbing for roots, as the cuts were unscratched, and must have been made with an even-edged chopper.

A. S. Kennard pointed out (*10*, p. 149) that "From the differences between the cut portion of the bone and the natural surface, he considered it possible that the bone was not in a fresh state when cut."

I think it highly probable that when this alleged "bone implement" is carefully studied it will be found that the terminal facets were produced by a sharp metal blade probably of the Sheffield steel variety; in short, that this "bone implement" is quite as much a fake as the mandible.

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References

1. J. S. Weiner, K. P. Oakley, and W. E. Le Gros Clark, *Bull. Brit. Museum, Geol.* **2**, 141 (1935).
2. S. L. Washburn, *American Anthropologist* **55**, 759 (1953).
3. W. L. Straus, Jr., *Science* **119**, 265 (1954).
4. M. F. Ashley Montagu, *Am. J. Phys. Anthrop.* **8**, 1 (1951).
5. C. Dawson and A. S. Woodward, *Quart. J. Geol. Soc. London* **70**, 82 (1914).
6. A. T. Marston, *J. Roy. Anthrop. Inst.* **67**, 339 (1937).
7. ———, in *Special or Dental Anatomy and Physiology*, T. W. Widdowson, Ed. (Dale, London, 1939), p. 275.
8. ———, *Brit. Dental J.* **88**, 292 (1950).
9. K. P. Oakley and J. S. Weiner, *Nature* **172**, 1110 (1953). Note added in proof: Oakley [*Proc. Geol. Soc. London*, No. 1508, xlvi (1954)] has also shown that other flints recorded as implements recovered from the Piltdown gravel were probably artificially stained.
10. C. Dawson and A. S. Woodward, *Quart. J. Geol. Soc. London*, **71**, 144 (1915).
11. K. P. Oakley, *Man the Tool-Maker* [Brit. Museum (Nat. Hist.), London, ed. 2, 1950], p. 70.

Received April 19, 1954.

Security System (*cont. from page 7A*)

Then came the expression that seems so frankly astonishing as a criterion of security—the degree of enthusiasm:

> The board finds that if Dr. Oppenheimer had enthusiastically supported the thermonuclear program either before or after the determination of national policy, the H-bomb project would have been pursued with considerably more vigor, thus increasing the possibility of earlier success in this field.

The criterion of enthusiasm should be examined both by itself and in connection with the question of whether a standard that is appropriate for a lesser man should be applied to one of Dr. Oppenheimer's great talents and contributions. The board argued that except in time of critical national need the same standard must apply to all. But if identity of standard is to apply to the denial of clearance, it would seem logical to apply a similar doctrine to the granting of clearance. It is doubtful whether that was done. It was apparently not alone Dr. Oppenheimer's lack of enthusiasm for the thermonuclear program, or his opposition to that program at one stage of its discussion: it was his prominence, the fact that his opposition was widely known, his failure to publicize the fact that he was supporting a decision which had gone counter to his recommendation; it was these things that the majority members of the board concluded had delayed progress on the H-bomb. Would an unknown and uninfluential technician have been judged by the same standard? The wording of the report suggests not.

It is well that the criterion of enthusiasm was so clearly put. Its implications are too grave and frightening to have the basic issue clouded. It has been pointed out by a variety of writers that adherence to such a doctrine will dampen free discussion—not only in public but in secret councils. Who wants to risk such drastic punishment, years after a decision was made, for having honestly opposed the decision before it was made? Does the same fate now face the other members of the AEC advisory committee who agreed with Dr. Oppenheimer? In perhaps the most trenchant "editorial" on this point, Herbert Block, the brilliant cartoonist of the *Washington Post and Times-Herald* pictured an office labeled "U.S. Govt. Atomic Science." On the wall hung an admonitory plaque reading, ENTHUSE. In the wastebasket rested its discarded predecessor, THINK.

In two quite distinct senses the outcome of the review board's work has been contradictory and confusing. Dr. Oppenheimer has been found to be loyal and discreet, but two of the three board members voted against restoring his clearance. But Dr. Oppenheimer was not alone on trial. The case also constituted a trial of the security system itself. Like Dr. Oppenheimer, in one sense it too came out with unblemished reputation. A thoughtful board devoted weeks to the case; many witnesses came to the defense of a man whose character had been questioned; Dr. Oppenheimer was permitted to cross-examine adverse witnesses; a valuable analysis of some of the underlying and terribly perplexing problems of the relations between national security and individual freedom of action has become available; nor is that all, for there will be further review before a final decision is reached. In this democratic, judicial, fair procedure, the country can take great pride.

But the process does not go on in a vacuum. The process brings out some of the difficulties of the security regulations, some of the troublesome aspects of the attempt to judge who is a security risk, some of the tremendous cost to the nation that must lose the services of a uniquely qualified advisor in order to comply with regulations of unknown validity and perhaps temporary applicability. The majority report leaves the status of Dr. Oppenheimer in doubt. It also leaves doubts about the security regulations under which he was judged.

DAEL WOLFLE

June 5, 1954.

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December 26-31, 1954

In time or in cost, a trip from an eastern city to California is not much more than a **round trip** to a midwestern city. Californians who for years have been attending meetings in the East have told their colleagues that the continental distance is the **same** each way, and that it should be the turn of the Easterners to visit the Pacific Coast.

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Air coach (no meals)	$167.20	$215.60	$217.80
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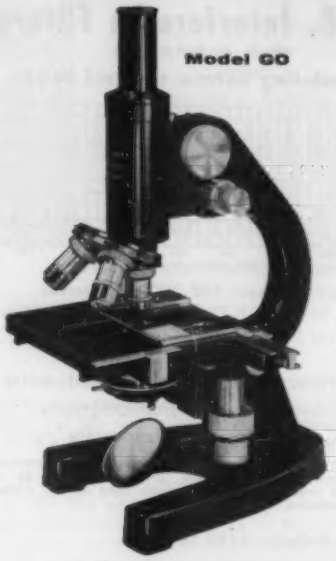

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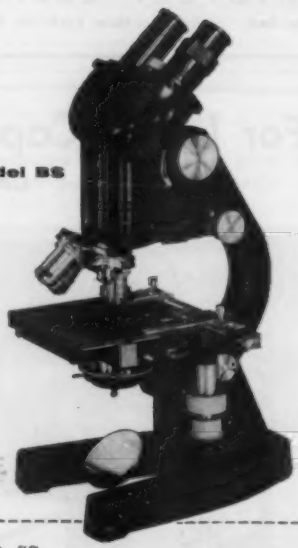

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The Trial of a Security System

AFTER weeks of arduous work, a special personnel security board of the Atomic Energy Commission has concluded that Dr. J. Robert Oppenheimer is of unquestioned loyalty to the United States but that his clearance should not be reinstated. Reactions to these decisions have been prompt and vigorous. Among them, Mr. Walter Lippman echoed an attitude he had expressed at the time the case first became public information: "The one intolerable result is the result we have got, a divided, confused, contradictory verdict that raises enormous issues and settles none of them."

Enormous issues are raised. The review board has asked itself questions of the utmost importance concerning relations between the nation's security system and the rights of individual men. The report is a provocative document which merits careful study in its entirety. Yet it comes to conclusions that to many —including one of the three members of the review board itself—appear contradictory. Clearly the case cannot be allowed to rest here. Whatever in the way of additional process precedes the final decision, the contradiction and inconclusiveness of the review board's recommendations, and of some of the bases upon which they were made, must be removed. Until this is done, the case will continue to be unfinished business.

The verdict of "loyal but a security risk" is logically defensible and has in fact been reached in other cases. A person may have not the slightest taint of disloyalty and yet be a security risk. If he is incautious in speech; if alcohol makes him overly loquacious; if immoral habits or the presence of near relatives in lands occupied by an unfriendly nation render him particularly susceptible to pressure, then it may be dangerous to entrust vital information to him. He is a security risk, even though his loyalty is unchallenged.

It is not therefore in the bare decision itself that the difficulty is to be found. Dr. Oppenheimer's loyalty was unquestioned. His discretion in handling classified information was commended. Why then was he not reinstated? The majority members of the board, Gordon Gray and Thomas A. Morgan, found the following four points to be controlling in leading to their decision:

1) We find that Dr. Oppenheimer's continuing conduct and associations have reflected a serious disregard for the requirements of the security system.

2) We have found a susceptibility to influence which could have serious implications for the security interests of the country.

3) We find his conduct in the hydrogen bomb program sufficiently disturbing as to raise a doubt as to whether his future participation, if characterized by the same attitudes in a Government program relating to the national defense, would be clearly consistent with the best interests of security.

4) We have regretfully concluded that Dr. Oppenheimer has been less than candid in several instances in his testimony before this board.

The first, second, and fourth of these points are debatable. They were controlling in the minds of two board members but not in the mind of the third. Debate on these points will unquestionably continue.

The third controlling factor—Dr. Oppenheimer's conduct in the hydrogen bomb program—is the most serious of the four, for it raises a basis for denying clearance that seems both foreign to democratic concepts and stultifying to the progress of military research and development. It had been charged that Dr. Oppenheimer opposed the development of the hydrogen bomb and that even after the decision to go forward with its development had been reached he had continued to oppose it, had declined to cooperate fully in the project, and had attempted to persuade other scientists not to work on the project. With regard to his initial opposition, there appeared to be no uncertainty: he had opposed it. Once the decision to go forward was made, however, the board found that Dr. Oppenheimer had not opposed it, did not decline to cooperate in the effort, and had not attempted to persuade others not to work on the project. However, the majority report goes on to point out that Dr. Oppenheimer's views had been widely known "and since he did not make it known that he had abandoned these views, his attitude undoubtedly had an adverse effect on recruitment of scientists and the progress of the scientific effort in this field."

(*Continued on page 886*)

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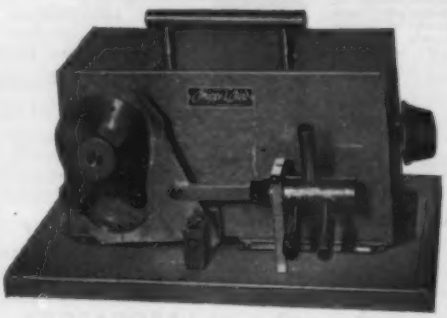

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Meetings & Conferences

July

19–23. International Cong. of Gerontology, 3rd, London and Oxford, Eng. (Mrs. A. Humpage, Tavistock Square, London, W.C.1.)

19–24. Pan American Cong. on Gastroenterology, 5th, São Paulo, Brazil. (J. Ramos, Av. Brigádeiro Luiz Antonio 278–80, São Paulo.)

19–31. French Assoc. for the Advancement of Science, Poitiers, France. (FAAS, 28 Rue Serpente, Paris 8.)

20–24. International Conf. on Thrombosis and Embolism, Basel, Switzerland. (W. Merz, Gynecological Clinic, Univ. of Basel.)

21–24. International Cong. of Medical Psychotherapy, Zurich, Switzerland. (H. K. Fiers-Monnier, Hauptstrasse 8, Kreuzlingen, Switzerland.)

21–28. International Cong. of Crystallography, 3rd, Paris, France. (J. D. H. Donnay, Johns Hopkins Univ., Baltimore, Md.)

23–29. International Cancer Cong., 6th, São Paulo, Brazil. (H. L. Stewart, National Cancer Inst., Bethesda, Md.)

25–31. Inter-American Cong. of Sanitary Engineering, 4th, São Paulo, Brazil. (L. Nogueira, Caixa Postal 8099, São Paulo.)

26–31. International Cong. of Gynecology and Obstetrics, Geneva, Switzerland. (W. Geisendorf, Maternité, Hôpital Cantonal, Geneva.)

27–28. International Union of Theoretical and Applied Mechanics, 4th, Brussels, Belgium. (H. L. Dryden, 1724 F St. NW, Washington 25, D.C.)

28–2. International Union for the Protection of Nature, 4th, Copenhagen, Denmark. (H. J. Coolidge, National Research Council, Washington 25, D.C.)

28–2. Symposium on Photoelasticity and Photoplasticity, Brussels, Belgium. (H. L. Dryden, 1724 F St., NW, Washington 25, D.C.)

August

1–2. Linguistic Soc. of America, Chicago, Ill. (A. A. Hill, 1719 Massachusetts Ave., NW, Washington 6, D.C.)

3–13. Pan American Federation of Engineering Societies, 3rd, São Paulo, Brazil. (H. Pegado, Edificio Maua, Viaduto Dona Paulina, São Paulo.)

9–15. International Cong. of Philosophy, São Paulo, Brazil. (M. Reale, Rua 24 de Maio 104–8, São Paulo.)

9–27. Summer Seminar in Statistics, 5th, Storrs, Conn. (G. Beall, Dept. of Statistics, Univ. of Connecticut, Storrs.)

10–14. Canadian Teachers' Federation, annual, Vancouver, Canada. (G. G. Croskery, 444 Mac Laren St., Ottawa.)

12–14. International Cong. on Group Psychotherapy, 1st, Toronto, Can. (J. L. Moreno, 101 Park Ave., New York 17.)

13–14. International Cong. on Child Psychiatry, Toronto, Can. (A. Z. Barhash, 186 Clinton Ave., Newark 5, N.J.)

13–21. World Poultry Cong., 10th, Edinburgh, Scotland. (Cong. Sec., Dept. of Agriculture for Scotland, St. Andrew's House, Edinburgh 1.)

14–21. International Cong. on Mental Health, 5th, Toronto, Can. (J. D. Griffin, 111 St. George St., Toronto 6.)

15–28. Pan Indian Ocean Science Cong., Perth, Western Australia. (A. D. Ross, 31 Ventnor Ave., West Perth.)

16–18. American Malacological Union, Durham, N.H. (M. Teskey, 144 Harlem Ave., Buffalo 24.)

Meetings & Conferences

August, *contd.*

18. Stanford Conf. on Population Problems of Latin America, Stanford, Calif. (R. Hilton, Hispanic American Studies, Stanford Univ., Stanford.)

19–20. National Council of Geography Teachers, San Francisco, Calif. (Mrs. I. C. Robertson, State Teachers College, Valley City, N.D.)

19–31. International Conf. of Ship Hydrodynamics, 7th, Göteborg, Sweden. (H. F. Nordstrom, Statens Skeppsprovningsanstalt, Göteborg.)

20–26. American Pharmaceutical Assoc., Boston, Mass. (R. P. Fischelis, 2215 Constitution Ave., NW, Washington 7, D.C.)

23–26. American Veterinary Medical Assoc., annual, Seattle, Wash. (J. G. Hardenbergh, 600 S. Michigan Ave., Chicago 5, Ill.)

23–28. International Cong. for the Philosophy of Science, 2nd, Zurich, Switzerland. (Sec., Internationales Forum Zurich, Room 20d, Eidengenssische Hochschule, Zurich 6.)

23–28. International Cong. of Soil Science, 5th, Leopoldville, Belgian Congo. (F. A. van Baren, Royal Tropical Inst., Mauritskade 63, Amsterdam, Netherlands.)

23–28. International Photobiological Cong., Amsterdam, Netherlands. (Cong. Sec., Radiologische Laboratorium, Wilhelminagasthuis, Amsterdam.)

23–3. International Scientific Radio Union, 11th, The Hague, Netherlands. (I. E. Herbays, 42 Rue des Minimes, Brussels, Belgium.)

25–27. American Phytopathological Soc., annual, Estes Park, Colo. (G. S. Pound, Dept. of Plant Pathology, Univ. of Wisconsin, Madison.)

25–27. Biological Photographic Assoc., 24th annual, Atlantic City, N.J. (A. F. Hancock, Photo Unit, Jefferson Hospital, 1020 Sansom St., Philadelphia 7.)

25–27. Western Electronics Show and Convention, Los Angeles, Calif. (M. Mobley, Jr., 344 N. LaBrea Ave., Los Angeles 36.)

28–29. Soc. for Social Responsibility in Science, annual, Yellow Springs, Ohio. (SSRS Office, Gambier, Ohio.)

30–31. Mathematical Assoc. of America, 35th summer, Laramie, Wyo. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

30–1. American Soybean Assoc., 34th annual, Memphis, Tenn. (G. M. Strayer, ASA office, Hudson, Iowa.)

30–3. International Soc. of Orthopedic Surgery and Traumatology, 6th, Bern, Switzerland. (M. Dubois, Isle-Hospital, Bern.)

30–3. International Symposium on Combustion, 5th, Pittsburgh, Pa. (B. Lewis, Alcoa Bldg., Pittsburgh 19.)

30–9. International Mathematical Cong., Amsterdam and The Hague, Netherlands. (M. H. Stone, Dept. of Mathematics, Univ. of Chicago, Chicago 37, Ill.)

31–3. American Mathematical Soc., summer, Laramie, Wyo. (E. G. Begle, AMS, Yale Univ., New Haven, Conn.)

31–10. UN World Population Conf., Rome, Italy. (J. D. Durand, Room 3025B, UN Bldg., New York.)

31–10. World Population Cong., Rome, Italy. (F. Lorimer, American Univ., Washington 16, D.C.)

September

1–7. International Soc. for Cell Biology, 8th, Leiden, Netherlands. (W. H. K. Karstans, Botanical Laboratory, State University, Nonnensteig 3, Leiden.)

Meetings & Conferences

September, *contd.*

1–8. British Assoc. for the Advancement of Science, annual, Oxford, England. (Sec., BAAS, Burlington House, London, W.1.)

1–8. International Cytological Cong., Leiden, Netherlands. (P. G. Gaillard, Histologisch Laboratorium, Rijksuniversiteit, Leiden.)

1–11 International Committee of Electrochemical Thermodynamics and Kinetics, 6th annual, Paris and Poitiers, France. (P. Van Rysselberghe, Dept. of Chemistry, Univ. of Oregon, Eugene.)

1–16. International Electrotechnical Commission, 50th, Philadelphia, Pa. (U.S. Committee, American Standards Assoc., 70 E. 45 St., New York 17.)

2–9. International Cong. of Mathematicians, annual, Amsterdam, Netherlands. (Sec., 2d Boerhaavestraat 49, Amsterdam.)

3–7. International Symposium on Infrared, Parma, Italy. (S. S. Ballard, The Rand Corp., Santa Monica, Calif.)

3–8. American Psychological Assoc., annual, New York City. (F. H. Sanford, 1333 16 St., NW, Washington 6, D.C.)

3–8. Psychometric Soc., annual, New York City. (J. B. Carroll, Harvard Univ., 13 Kirkland St., Cambridge 38, Mass.)

5–9. American Inst. of Biological Sciences, Gainesville, Fla. (F. L. Campbell, 2101 Constitution Ave., Washington, D.C.)

5–9. American Bryological Soc., Gainesville, Fla. (L. J. Gier, Dept. of Biology, Wm. Jewell College, Liberty, Mo.)

5–9. American Fern Soc., Gainesville, Fla. (W. H. Wagner, Dept. of Botany, Univ. of Michigan, Ann Arbor.)

5–9. American Soc. for Horticultural Science, Gainesville, Fla. (F. S. Howlett, Ohio Agricultural Experiment Station, Wooster.)

5–9. American Soc. of Human Genetics, Gainesville, Fla. (S. C. Reed, Univ. of Minnesota, Minneapolis 14.)

5–9. American Soc. of Ichthyologists and Herpetologists, Gainesville, Fla. (A. Grobman, Dept. of Biology, Univ. of Florida, Gainesville.)

5–9. American Soc. of Limnology and Oceanography, Gainesville, Fla. (B. H. Ketchum, Woods Hole Oceanographic Institution, Woods Hole, Mass.)

5–9. American Soc. of Naturalists, Gainesville, Fla. (W. S. Spencer, Dept. of Biology, Wooster College, Wooster, Ohio.)

5–9. American Soc. of Plant Physiologists, Gainesville, Fla. (J. F. Stanfield, Miami Univ., Oxford, Ohio.)

5–9. American Soc. of Plant Taxonomists, Gainesville, Fla. (R. C. Rollins, Gray Herbarium, Harvard Univ., Cambridge 38, Mass.)

5–9. Assoc. of Southeastern Biologists, Gainesville, Fla. (M. E. Gaulden, Biology Div., Oak Ridge National Laboratory, Oak Ridge, Tenn.)

5–9. Biometric Soc. ENAR, Gainesville, Fla. (A. M. Dutton, Box 287, Station 3, Rochester 20, N.Y.)

5–9. Botanical Soc. of America, Gainesville, Fla. (H. B. Creighton, Dept. of Botany, Wellesley College, Wellesley 81, Mass.)

5–9. Ecological Soc. of America, Gainesville, Fla. (J. F. Reed, Dept. of Botany, Univ. of Wyoming, Laramie.)

5–9. Genetics Soc. of American, Gainesville, Fla. (C. P. Oliver, Dept. of Zoology, Univ. of Illinois, Urbana.)

Meetings & Conferences

September, *contd.*

5–9. Mycological Soc. of America, Gainesville, Fla. (L. Shanor, Dept. of Botany, Univ. of Illinois, Urbana.)

5–9. National Assoc. of Biology Teachers, Gainesville, Fla. (J. P. Harrold, 110 E. Hines St., Midland, Mich.)

5–9. The Nature Conservancy, Gainesville, Fla. (G. B. Fell, 607 G St., SE, Washington 3, D.C.)

5–9. Phi Sigma Soc., Gainesville, Fla. (F. S. Orcutt, Dept. of Biology, Virginia Polytechnic Inst., Blacksburg.)

5–9. Sigma Delta Epsilon, Gainesville, Fla. (M. Gojdics, Barat College, Lake Forest, Ill.)

5–9. Soc. of Protozoologists, Gainesville, Fla. (N. D. Levine, College of Veterinary Medicine, Univ. of Illinois, Urbana.)

5–9. Soc. for the Study of Evolution, Gainesville, Fla. (H. Lewis, Dept. of Botany, Univ. of California, Los Angeles 14.)

6–9. Conf. on the Physics of the Ionosphere, Cambridge, England. (J. A. Ratcliffe, Cavendish Laboratory, Cambridge.)

6–10. International Conf. of Geographic Pathology, 5th, Washington, D.C. (R. A. Moore, School of Medicine, Washington Univ., St. Louis 10, Mo.)

6–10. International Cong. of Clinical Pathology, 2nd, Washington, D.C. (R. A. Moore, School of Medicine, Washington Univ., St. Louis 10, Mo.)

6–10. International Poliomyelitis Conf., 3rd, Rome, Italy. (S. E. Henwood, 120 Broadway, New York 5.)

6–11. International Soc. of Hematology, 5th, Paris, France. (S. Haberman, 3600 Gaston Ave., Dallas, Tex.)

7. Phycological Soc. of America, Gainesville, Fla. (R. H. Thompson, Dept. of Botany, Univ. of Kansas, Lawrence.)

7–10. Alaska Science Conf., 5th, Anchorage, Alaska. (AAAS, Box 960, Anchorage.)

8–9. Soc. of General Physiologists, annual, Woods Hole, Mass. (J. B. Buck, National Institutes of Health, Bethesda 14, Md.)

8–10. American Physiological Soc., Madison, Wis. (W. B. Youmans, Dept. of Physiology, Univ. of Wisconsin, Madison.)

8–10. American Soc. of Mechanical Engineers, fall, Milwaukee, Wis. (O. B. Schier, II, 29 W. 39 St., New York 18.)

8–10. American Sociological Soc., Urbana, Ill. (J. W. Riley, Jr., A.S. Soc., New York Univ., New York 3.)

9–11. American Political Science Assoc., annual, Chicago, Ill. (J. Gange, 1785 Massachusetts Ave., NW, Washington 6, D.C.)

9–17. International Cong. of Ophthalmology, 17th, Montreal, Canada, and New York, N.Y. (W. L. Benedict, 100 First Avenue Bldg., Rochester, Minn.)

10–12. Gerontological Soc., Gainesville, Fla. (A. J. Carlson, Univ. of Chicago, Chicago 37.)

10–13. Inst. of Mathematical Statistics, American Statistical Assoc., and Econometric Soc., Montreal, Canada. (K. J. Arnold, Dept. of Mathematics, Michigan State College, East Lansing.)

10–16. International Symposium on Problems in Contemporary Optics, Florence, Italy. (S. S. Ballard, The Rand Corp., Santa Monica, Calif.)

10–24. American Soc. of Photogrammetry, Philadelphia, Pa. (C. E. Palmer, 1000 11 St., NW, Washington 1, D.C.)

Meetings & Conferences

September, *contd.*

12–16. American Inst. of Chemical Engineers, Glenwood Springs, Colo. (C. H. Prien, Research Inst., Univ. of Denver, Denver 10, Colo.)

12–16. Illuminating Engineering Soc., Atlantic City, N.J. (A. D. Hinckley, 1860 Broadway, New York 23.)

12–17. American Chemical Soc., annual, New York City. (R. M. Warren, 1155 16 St., NW, Washington 6, D.C.)

12–17. International Assoc. for the Prevention of Blindness, New York City. (Prof. Franceschetti, 3 Ave. Miremont, Geneva, Switzerland.)

12–17. International Cong. of Cardiology, Washington, D.C. (L. W. Gorham, American Heart Assoc., 44 E. 23 St., New York 10.)

12–17. International Organization Against Trachoma, Montreal, Can. (A. Sorsby, 45 Lincoln's Inn Field, London W.C.2.)

13–14. American Microscopical Soc., annual, Philadelphia, Pa. (C. J. D. Brown, Dept. of Zoology and Entomology, Montana State College, Bozeman.)

13–15. Analytical Instrument Clinic, 3rd annual, Philadelphia, Pa. (A. H. Peterson, 4400 5 Ave., Pittsburgh 13, Pa.)

13–17. Assoc. of Applied Biologists, 50th anniversary, London, Eng. (R. K. S. Wood, Imperial College of Science and Technology, London, S.W.7.)

13–18. International Cong. of Nutrition, 3rd, Amsterdam, Netherlands. (M. van Eekelen, 61 Catharynesingel, Utrecht, Netherlands.)

13–19. International Cong. on Industrial Medicine, 11th, Naples, Italy. (Sec. of Cong., Istituto Medicine del Lavoro, Universita, Policlinico, Piazza Miraglia, Naples.)

13–19. International Soc. of Blood Transfusion, 5th, Paris, France. (Col. Julliard, 57 Boulevard d'Auteuil, Boulogne sur Seine, France.)

13–20. International Soc. of the History of Medicine, 14th, Rome and Salerno, Italy. (M. Galeazzi, Citta Universaitaria, Rome.)

13–25. International Instrument Cong. and Exposition, 1st, Philadelphia, Pa. (R. Rimbach, 921 Ridge Ave., Pittsburgh 12, Pa.)

14–29. International Union of Geodesy and Geophysics, Rome, Italy. (W. E. Smith, 1530 P St., NW, Washington 5, D.C.)

15. International Cong. of Industrial Chemistry, 27th, Brussels, Belgium. (Mr. Guilmot, 32 Rue Joseph II, Brussels.)

15–18. International Cong. of Internal Medicine, 3rd, Stockholm, Sweden. (A. Kristenson, Karolinska Sjukhuset, Stockholm 60.)

17–18. Calorimetry Conf., 9th annual, Schenectady, N.Y. (W. De Sorbo, GE Research Laboratories, Schenectady.)

21–23. Soc. for Experimental Stress Analysis, Philadelphia. (W. M. Murray, Central Square Station, P.O. Box 168, Cambridge 39, Mass.)

21–24. American Roentgen Ray Soc., Washington, D.C. (B. R. Young, Germantown Hospital, Philadelphia 44, Pa.)

22–24. Conf. on the Protection of Plants in Hot Climates, Marseilles, France. (P. Bonnet, Palais de la Bourse, Marseilles.)

22–24. Mississippi Valley Medical Soc., 18th annual, Chicago, Ill. (H. Swanberg, 209–224 W.C.U. Bldg., Quincy, Ill.)

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